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Fig. 1.—The city of Leipzig as it appeared to the passengers of the "Parseval III."—[See page 24.]

FINDING YOUR WAY IN THE AIR

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

The Subway Muddle

A FEW years since the SCIENTIFIC AMERICAN had much to say about the development of New York's system of subways. For the past year or two, as our readers know, we have been silent on the question; and this for the reason that we have found it practically impossible to suggest any best way out of the maze of opposing schemes which have been presented and discussed. When the idea of building the Tri-borough Subway took definite form, we had hoped that out of the melting pot into which the propositions and counter-propositions of the Public Service Commission and the Interborough and Brooklyn Rapid Transit Companies had been cast by the city officials, there would have come a comprehensive and acceptable scheme which would serve the best interests, both of the public and the operating company. But we have to confess that the practical results, if they may be called such, seem to us at the presnt writing to be decidedly disappointing.

After a careful consideration of the discussions of the past few months, we find ourselves more and more inclined to agree with our practical and far-sighted Mayor, in his conviction that the best policy of the city would be to permit the Interborough, the present operating company, to build all the needed extensions in Manhattan, the Bronx, Brooklyn, and Long Island, and operate them for a single five-cent fare. But we would attach to this proposition a most important clause—namely, that the hands of the Public Service Commission should be strengthened to give them such an immediate control of the operating features of the road that the comfort, convenience, and proper self-respect of the traveling public, will be absolutely safeguarded.

But let it be understood, just here, that we hold no brief for the Interborough Company. On the contrary, we believe that their extreme unpopularity, of which they must surely be very well aware, is fully deserved, being due to the obstructionist attitude which they have shown to the requests of the New York public as expressed through its representatives, the Public Service Commission, notably in the matter of providing accommodations in those intervals between the rush hours, in which, if the Interborough had shown a friendly and reasonable attitude, it could easily have provided a seat for practically every passenger. There was a period of several months during which the attitude of the Interborough to its patrons, as expressed in their obstructionist policy to the Public Service Commission, was one of supercilious contempt and total disregard either for their convenience or comfort.

On the other hand, we wish it to be clearly understood that on the purely physical, the engineering side, we consider the work of the Interborough in perfecting its system to have been simply magnificent. In no other city can there be found twenty-five miles of road which, in the combined speed and number of its trains, in the perfection of its signaling system, in the multiplication of safeguards against disaster, and in the enormous multitudes that are carried day in and day out, with practically no accidents whatever, can compare with the New York subway as operated by the Interborough Company. In the effort to get the largest number of trains over their tracks in the shortest possible time, the company appear to have made cost the last consideration.

In view of the above facts, it is simply amazing that they should have shown such a "picayune" spirit, in hastening to cut off cars the moment the rush hour was over, and at the very time when the wonderfully patient New Yorker would naturally look for a seat.

Now the Interborough Company is extremely anxious to build the whole subway system as originally laid out by the Rapid Transit Commission, with such further enlargements as the growth of the city and the demands of Brooklyn and Staten Island have made imperative. With paste pot and placard they have spread their appeal on car and platform, and elevated pillar. There is no question whatever about the anxiety of the Interborough to keep out every competitor and build a "five-borough route operated for a five-cent fare."

But this slogan of the Interborough is nothing more nor less than the dream of the average workaday citizen of New York. He wants it badly, but he also wants it comfortably, decently, and rid of those brutalities which disgrace the Interborough's present methods of handling their passengers. The ten-car train in rush hours has done much to mitigate the horrors of subway travel; the eight-car train between rush hours would have a similar effect. The average citizen cares very little who builds, owns, or operates a "five-borough, five-cent" system; but he cares very much indeed whether the system is to be operated along the lines of disgusting indecency which mark the present methods, and he demands that whatever new system may be built, it shall be no longer necessary, when he gives up his five-cent fare, to also forego his self-respect, his elementary sense of decency and his native inborn chivalry toward women.

Now the SCIENTIFIC AMERICAN pointed out some months ago that the reasonable comfort of the passenger could be secured if the representatives of the traveling public, namely, the Public Service Commission, were empowered to see that their mandates were carried out to the letter by the operating company. To do this, it would be necessary merely to insert a clause in the contract with the operators of the subway, to the effect that whenever an employee, big or little, of the operating company, became obnoxious through failure to follow the orders of the Public Service Commission, the Commission would have power to summarily dismiss him, be he train-guard, center rush at car doors, or general manager.

Such a clause is to be found to-day in the printed forms of contracts for big city works—bridges, public buildings, etc. The same policy is followed in all great railroad contracts throughout the country. It works like a charm. What the chief engineer says, goes; and it is extremely rare for him to have to exert the drastic authority with which he is invested.

So the SCIENTIFIC AMERICAN would suggest that the Interborough Company be permitted to carry out he programme of construction which it has so prayerfully submitted to its long-time pushed and elbowed and buffeted patrons, with the understanding, however, that they, the patrons, are to be placed in a position where they can demand and enforce every possible consideration as to accommodation and courteous treatment that the exigencies of the situation will allow.

Necessity and Invention

ANYONE who scans a copy of the *Patent Office Gazette* with the notion that necessity is the mother of the entire brood of inventions therein contained, is destined to receive a rude shock. What an enormous family! Nine hundred and ninety-seven thousand to date, and increasing at the rate of six hundred new little necessities each week! But what an odd and varied brood, and are they all really necessities? Here is a strange one that was actually patented—a scheme for controlling horses by electricity. If the animal balks, a powerful and well-placed shock will make him spring forward in spite of himself. If he tries to kick, his muscles will be cramped by a paralyzing charge of electricity. Instead of bridle and reins, the all-powerful current may be used to give him a shock on the left cheek in order to turn into the right fork of the road, or on the right to make him take a left turn. Instead of sawing away at the lines, the driver may sit back in comfort, and, by means of push-buttons, typewrite the beast into submission.

Needless to say, this weird invention is an intruder in Mother Necessity's family. Alas! there are many such intruders. But a large number of inventions equally unnecessary are not so palpably foolish. The worst offender is the man who is not content with developing and improving the arts in which he is regularly employed, but feels that he must do missionary work in strange and unfamiliar territory. A farmer who has never been beyond the boundary of his own county will invent fire escapes for skyscrapers. A city clerk whose knowledge of the country has been gained from a trip to Bronx Park will invent an automobile plow. Sailors on the high seas will tackle the baffling problem of making safe rail joints, while the man from the Middle West almost invariably turns his attention to ship propellers and wave motors. An idea comes to such a man and he hastens to the Patent Office with it. It may be that he will give it a superficial examination; but the chances are that he will think it unnecessary to make his examination thorough, or else he will be afraid of divulging his secret by too searching an investigation.

Not long ago a man was struck with the brilliant conception of having rotary heels on shoes, the idea being that the wear would be evenly distributed and that the heels would not be run down on one side. The invention seemed so original to him that he thought it unnecessary to investigate the state of the art; however, he was persuaded to have a search of the Patent Office made, and much to his astonishment he found an entire sub-class devoted to this one particular branch of shoe-making, in which scores of patents had been secured on every phase of the idea. Of course this inventor's design was slightly different from the rest, and he might have secured a patent with a limited claim or two; but he was wise enough to see that his scheme was not necessary, and was therefore useless.

Until he has discovered the fact by rude personal experience, it is usually hopeless to tell a man with an idea that his invention is unnecessary. A man who is dabbling in arts of which he knows little or nothing will not listen to advice. You cannot tell him that invention, like charity, begins at home, because it does not, always. There have been exceptions, and notable ones, too, in which a man who is unfamiliar with a process or machine for doing a certain kind of work has attacked the problem from an entirely original point of view, and has developed an improvement of great value. It is these exceptions that encourage the precipitate man to begin invention in foreign fields.

We do not wish to create the impression that it is only the necessary invention that is worth while. Many of them appear unnecessary, and actually are unnecessary until the necessity for them has been naturally or artificially created. Many years ago a thin, emaciated young man in Boston who was literally starving, spent all his time with a series of experiments that seemed absolutely worthless. He carried his investigation so far as to employ a mummied human ear, and many an evening he spent whispering in this ghastly ear, trying to record the vibrations of the ear drum. The outcome of these experiments is the telephone of to-day. It was an unnecessary invention when first patented, a scientific toy, and no one seemed to see any particular value in it; but the need for it was built up after the invention was made. Verily, the successful inventor must be prophetic, in seeing a real necessity for his device, and the preliminary to success lies in careful, painstaking study and a thorough knowledge of every phase of the art.

The Bad Spelling of the Great

THE numerous members of the rank and file of humanity who have trouble in remembering the number of *n's* and *t's* in "Britannica" will derive much consolation from examining a pamphlet recently circulated by the publishers of the new edition of the world's greatest encyclopædia. This pamphlet contains facsimile reproductions of letters received from eminent people—college presidents and professors, judges, senators, and others—expressing their appreciation of the new work. Of seventy letters, some typed and the rest in autograph, no less than seven—ten per cent—misspell the word "Britannica."

So far as the purely scientific vocabulary is concerned, probably the word more often misspelled than any other is "sidereal." We notice that *Science* reports the fact that Prof. Svante Arrhenius recently lectured before the Washington Academy of Science on "The Siderial Cultus," and this announcement has been copied, in its original orthography, in the *Bulletin of the American Geographical Society*. As it happens this little slip on the part of two usually impeccable publications was entirely gratuitous, for the reason that the distinguished Swedish *savant* changed his programme at the last moment, and delivered a lecture on "The Atmosphere of the Planets."

George Ellery Hale

America's Foremost Solar Physicist

By Frederick Slocum of the Yerkes Observatory Staff

IN the report of the president of the Carnegie Institution of Washington for 1905 appears a list of the departments of scientific investigation to which the larger grants were assigned and the amounts of those grants. The sum of the sixteen grants mentioned is $304,500. One item in the list is "Solar Observatory, $150,000." According to the report for the next year a second grant of an equal amount was made to the Solar Observatory, and in each of the subsequent years large amounts have been assigned to the same institution. This fact has a two-fold significance; first, it shows the importance of solar research and the allied investigations which tend to interpret the universe, and secondly, it signifies the great faith of the trustees of the Carnegie Institution in the one man who was selected to build and direct its great Solar Observatory. This man was Prof. George Ellery Hale of Chicago. Prof. Hale was born in Chicago in 1868. He received his collegiate education at the Massachusetts Institute of Technology, from which he obtained the degree of B.S. in 1890. While in college he had been especially interested in physics, and particularly that part of physics which involves spectroscopy. In 1888 he established a private physical laboratory in Chicago, which was known as the Kenwood Physical Observatory. In all of his mechanical and scientific tests a thorough course in manual training stood him in good stead, and he was especially fortunate in having the constant encouragement of his father, a successful inventor, manufacturer and business man. In 1891 the observatory was equipped with a 12-inch Brashear telescope and a powerful spectroscope. Prof. Hale's program, as announced at the dedication of his private observatory in 1891, called for "a thorough study of solar phenomena and particularly spectroscopic investigations of the spots, chromosphere, and prominences." For twenty years this program has formed the basis of all of his researches, and the success which he has achieved has completely revolutionized the methods of solar investigation as well as the interpretation of solar phenomena.

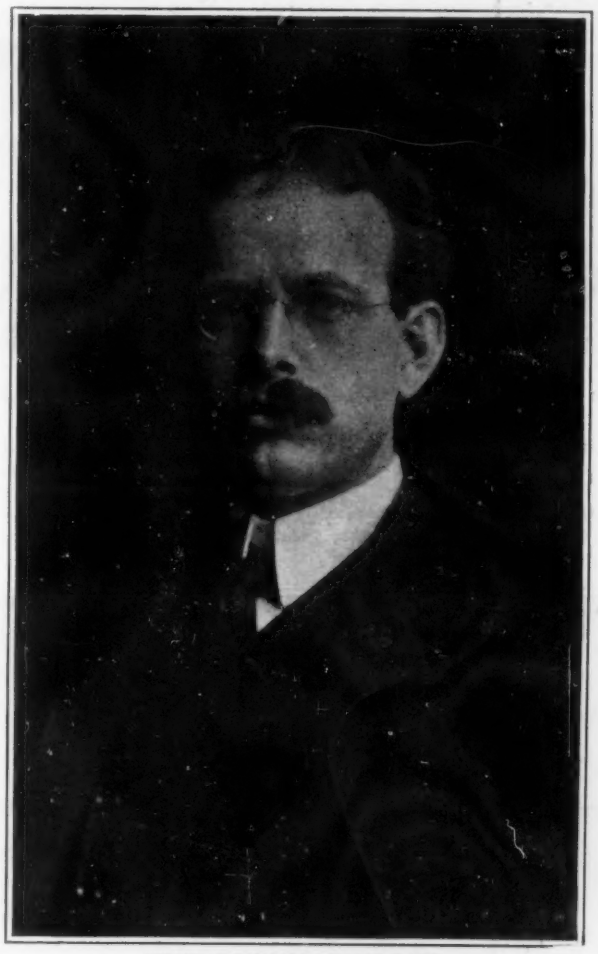
While still a student at the Massachusetts Institute of Technology Hale became interested in the study of the sun, and published several articles on that subject in the Massachusetts Institute of Technology *Quarterly* and in the *Astronomische Nachrichten*.

The particular phase of solar research that interested him at that time was the study of prominences. For years these objects had been observed only during total eclipses of the sun. After the eclipse of 1868 Janssen and Lockyer had independently discovered a method of using the spectroscope so as to render the prominences visible in full sunlight. Prof. Hale attacked the problem of photographing the prominences. His first experiments were performed at the Harvard College Observatory in 1889 and 1890, but met with poor success. His failure, however, was due to inadequate apparatus for his special problem rather than to any fault in his method, and this led to the construction and equipment of the Kenwood Astrophysical Observatory in 1891.

Within a year from the time this observatory was dedicated the problem was solved by the invention of an instrument called by Prof. Hale a *spectroheliograph*. Without going into the technical details of this instrument, it may be described as a spectroscope so modified that any single line of a spectrum may be isolated and a photograph taken in the light of the element which produces the line. The spectrum of a solar prominence consists chiefly of the lines of hydrogen, helium and calcium. Using the *K* line of the latter element, Prof. Hale succeeded in making beautiful prominence photographs. A single exposure of two or three minutes' duration gave a record of all the prominences around the edge of the sun. By taking successive photographs at any convenient interval the changes in shape and general behavior of these most interesting solar features could be studied at will.

As soon as the spectroheliograph was put into practical use it was found that the photography of the prominences was only one of many lines of solar research to which it was adapted. It rendered possible photographs of the sun in the light of any one of the elements which are conspicuous on its surface. These photographs show not only the distribution of such elements as hydrogen and calcium over the sun's surface, and the changes in this distribution from day to day, but also show how the clouds of the different gases vary in size, shape and distribution at different heights above the surface of the sun.

The spectroheliograph opened up a new and wide field of solar research. Before it had been in use a year many new phenomena were discovered and many new theories of old phenomena were suggested. These brought honors in abundance to Prof. Hale. In 1895 the French Academy of Sciences awarded him the Janssen medal "for the construction and use of the first successful spectroheliograph." This was followed, in 1902, by the Rumford medal of the American Academy of Science, in 1903 by the Draper medal of the National Academy of Sciences, and in 1904 by the gold medal of the Royal Astronomical Society. Honorary membership in many foreign societies was conferred upon him. Colleges and universities have also paid tribute to his genius, and he has received honorary degrees from various institutions, including Yale, Manchester, Oxford and Cambridge.



PROF. GEORGE ELLERY HALE

Director of the Mount Wilson Solar Observatory.

Just as Prof. Hale's experiments at the Harvard Observatory led to the establishment of the Kenwood Observatory with its more specialized equipment, so his success in the researches carried on in the latter institution led to a desire for a larger observatory with more powerful instruments. The matter was brought to the attention of President Harper of the University of Chicago, who took an active interest in the realization of the plan. Mr. Charles T. Yerkes agreed to finance the undertaking, and the outcome was the great Yerkes Observatory of the University of Chicago, located at Williams Bay, Wisconsin, 76 miles northwest of Chicago. Ground was broken in 1893, and the observatory was dedicated in October, 1897. Prof. Hale was appointed director of the observatory and professor of astrophysics in the University of Chicago. A complete description of the Yerkes Observatory would be out of place here. It will be sufficient to note that the chief instrument is a refracting telescope with a lens 40 inches in diameter and a focal length of 63.5 feet, the largest telescope of its kind in the world. There are various other telescopes designed for special purposes and a complete equipment of accessories. The observatory and its equipment cost approximately $365,000.

The chief aim of the Yerkes Observatory was a continuation on a much more elaborate scale of the work so successfully begun at the Kenwood Observatory, but the program as announced by Prof. Hale included, in addition to the various classes of solar work, micrometrical observations of double stars, planets, satellites, nebulæ, comets, etc.; stellar parallax work; photographic studies of stellar spectra, including determinations of motion in the line of sight; photometric observations, and various physical researches in the laboratories. In order to carry out all of these researches a large staff was required, and Prof. Hale was fortunate in securing such men as Burnham, Barnard, Frost, Wadsworth, Ritchey, Ellerman, Adams, Barrett, Parkhurst and Fox.

For ten years Prof. Hale served as director of the Yerkes Observatory, and during that time the institution assumed a position among the foremost observatories of the world. In 1903 a combination of circumstances, including the completion of the five-foot mirror for a reflecting telescope, the gift of Prof. Hale's father; the desire to experiment under the very best conditions with new types of apparatus for solar observations, and the rigorous winters of Williams Bay, led to the decision to establish a branch observatory where the climatic conditions were most favorable. The summit of Mount Wilson near Pasadena, California, was finally selected as the site of the new station. For some months observations were made with instruments borrowed from the Yerkes Observatory, then the Carnegie Institution, devoted exclusively to the furtherance of research, agreed to finance the undertaking, and with the cordial co-operation of the University of Chicago, the new observatory severed its connection with the Yerkes Observatory, and in 1904 Prof. Hale became director of the Mount Wilson Solar Observatory of the Carnegie Institution of Washington. For the third time Prof. Hale had the privilege of planning and equipping an observatory.

In many respects the Mount Wilson Observatory is unique. It has no great building like the Yerkes Observatory, nor does it possess any large refracting telescope. Its instrumental equipment includes the Snow reflecting telescope with a mirror of 24 inches aperture and 60 feet focal length, mounted horizontally; a refracting telescope of 12 inches aperture and 60 feet focal length mounted vertically; a refracting telescope of 12 inches aperture and 150 feet focal length, mounted vertically; a reflecting telescope of 60 inches aperture and 25 feet focal length, mounted equatorially, and, in course of construction, a reflecting telescope of 100 inches aperture. The first three instruments are fixed in position, the light of the sun being reflected into them by a combination of mirrors. These three are designed exclusively for solar investigations, and are fully equipped with such accessories as spectrographs and spectroheliographs. These instruments are all mounted on the summit of Mount Wilson. In the city of Pasadena the observatory has a physical laboratory, a building with offices and computing rooms, and another containing machine, instrument, and optical shops.

Here again a large staff is necessary. In addition to Prof. Hale this includes at present Messrs. Adams, Ellerman and Ritchey, formerly of the Yerkes Observatory staff and also Messrs. St. John, Seares, Fath, King, Pease, Babcock and several assistants, computers and machinists.

Of the many achievements and discoveries of Prof. Hale and his colleagues at the Mount Wilson Observatory, a few only will be mentioned, viz.: Investigation with the spectroheliograph of hydrogen and calcium flocculi of the sun, including structure at different levels and relationship to spots, determination of the law of solar rotation (a) by the motions of the hydrogen and calcium flocculi, (b) by the

(Continued on page 37.)

How to Find Your Way in the Air

Aeronautical Signals; Aeronautic Charts; Steering by Compass

THE rapid progress of aviation and aeronautics obviously demands the development of a system of signals which will enable pilots to find their way in the air and will also indicate convenient landing places, atmospheric conditions, etc. Some of the most

Fig. 2.—A voyage over the Alps in the balloon "Augusta." View of Vill and Igls in the neighborhood of Innsbruck.

important events of the year are long cross-country flights. Racing in a small closed circuit will gradualy be abandoned. The establishment of regular lines of airship transit, as proposed by Count Zeppelin, and the success of aerial touring in general, also depend on the invention of such a system of signals.

One proposed method involves the construction of special aeronautical charts; another requires merely the establishment of easily visible signals by which the pilot can find his position on the very accurate ordnance maps which are commonly used as standard maps in France and other European countries. In the French system the country is divided into 258 districts, each of which extends about 38 miles east and west and 24 miles north and south, and is represented by a numbered section of the map.

According to one proposed system of signals, a large rectangle having the proportions of the corresponding map section and in the correct relative position to the points of the compass, will be marked out on the roof of a balloon shed or other building, or on the ground (Fig. 10.) The rectangle is marked with the number of the section, and the exact position of the locality in the section is indicated by a conspicuous mark. For example, the towns of Beauvais, in section 32, and Nantes, in section 117, would be indicated as is shown in Fig. 10b. A glance at any one of these signals near which he passes will show the pilot his exact place on the map, so that he need not be long lost or go far astray if the signals are sufficiently numerous. A predetermined course can be followed without carrying a set of maps. It is necessary only to draw, on a small card, a rough outline of the sections crossed by the course and adjacent thereto, to mark each section with its proper number, to mark the positions of the starting and destination points, and to connect these points by a straight line. A diagram for a flight from Orleans to Mourmelon is shown in Fig. 10b. It will be observed that the straight course crosses the northwestern part of section 81. Hence, if the aviator comes to the signal shown in the lowermost portion of Fig. 10b, which indicates a point in the southwestern part of section 81, he knows that he has deviated toward the right hand. The map is required only for the purpose of selecting a good landing place, if the goal is a large town.

If the signals are composed of white lines on a black background, or conversely, they need not be very large in order to be visible at a considerable distance. A rectangle 12 feet broad and 20 feet long, with lines 20 inches wide and figures 6 feet in height (in actual use at Mourmelon) is easily seen from a distance of one mile and an elevation of 600 feet.

In another system, indorsed by the French National Aerial League, each signal will consist of two numbers, indicating the distance in kilometers north or south, and east or west, of Paris. These signals can also be used in combination with the ordnance maps.

The lines, figures and backgrounds may be painted, or composed of colored tiles, etc. Figures composed of silvered glass balls have been employed in experiments at the Eiffel Tower (Figs. 3 and 4).

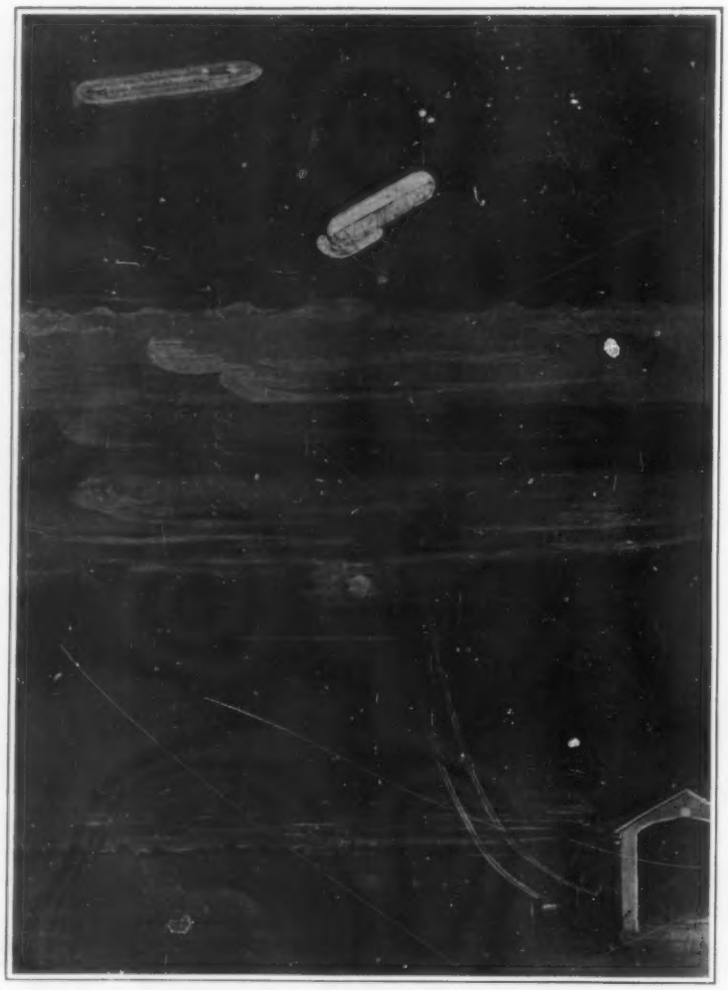


Fig. 3.—An air beacon.

CHARTING THE INVISIBLE OCEAN OF AIR

A person possessing good sight can distinguish parallel lines, properly illuminated, when each line and space has an angular breadth of 1 minute, and can recognize Roman capital letters which subtend an angle of 5 minutes. Hence the letters and figures of signals for the use of aviators flying 1,000 feet above ground should be at least 16 or 18 inches high, and should be composed of lines at least 3½ inches broad. These, however, are lower limits, which hold only for motionless, attentive and keen-sighted observers. The aviator's acuteness of vision, like that of most persons, may be somewhat impaired, and if he is alone his attention is distracted by the control of his machine, while even a separate observer finds it difficult to recognize objects which he passes at a speed of 50 miles per hour, or 75 feet per second. Hence the letters and figures should be from 3 to 5 feet high, and their lines from 7 to 12 inches broad. The "antique" capital letters and Arabic numerals adopted for oculists' use by the international ophthalmological congress of Naples in 1909, are the best for aeronautical signals. The more easily recognizable letters, such as A, E, V, should be preferred to the less easily recognizable, such as S, Z, B, R, and the employment of similar letters (M and N, or B and R), as well as the arrangement of letters and figures in one line should be avoided. Although vision is more acute in the open air at noon in clear weather than in an oculist's examining room, it must be remembered that only one day in three is perfectly clear, that aviators prefer the relatively calm morning and evening hours, when mists are frequent and sunlight is less intense, and that the air above large cities is usually laden with dust and smoke. These con-

ditions limit the choice of colors used in signals to black and white, or very dark and very light tints. As four or five men in a hundred are more or less color-blind, colored signals, which have caused many accidents on railways and in navigation, should be rejected.

In Germany, it has been suggested to divide the country into districts, and to designate each district by a number and a letter, which would be suitably inscribed on roofs or on signs suspended from captive balloons.

For the guidance of aviators and aeronauts at night a German inventor has devised a translucent red balloon about 8 feet in diameter, containing an electric light of 100 candles or more, and moored by means of an electric cable (Fig. 5). These balloons are easily distinguished from other lights, and from stars, and can be seen from a great distance. Some are already used near Berlin for guiding the nocturnal flights of an advertising airship. They may be employed as captive balloons for marking the positions of airship stations, sheds and landing places, and to indicate the proximity of the sea or other source of danger. They may also be equipped with accumulators and employed as pilot balloons, to indicate the direction and velocity of the wind before starting on a nocturnal flight. In foggy weather, the signal balloon may carry an automatic electric fog-signaling device by which a bell on the ground is rung when the balloon emerges from the bank of fog. These devices are patented and controlled by the Aix-la-Chapelle company.

A signal of a type which is already used to some extent in Belgium is shown in Fig. 6. It consists of a white cross of stone or wood, placed horizontally on the ground and inscribed in large black letters with the name of the place. The pointed top of the cross is directed northward, and supplementary arms indicate by their positions and inscriptions the distances and directions of landing places, shelters, forests, bodies of water, etc.

While aviators and aeronauts have been discussing the merits and demerits of various systems of marking places with signals that he who flies may read, the French War Department has commenced the construction of a map designed especially for use in aerial navigation. The need of such a map was felt keenly during the maneuvers in Picardy, where the pilots of the military airships were compelled to rely on the compass and the regular ordnance maps. The compass is of little utility except in long flights, and even then the lateral drift of the vessel makes it almost impossible for the pilot to keep his bearings, particularly if the view of the land is interrupted by fog. The ordnance maps are very accurate, but they are overloaded with details which only confuse the aerial pilot, who requires only a few conspicuous points of reference, which can be seen and recognized from a considerable distance. These points, as a rule, possess little military importance, and are, therefore, not very conspicuous in the ordnance maps.

The need of special aeronautic maps having been demonstrated by the first official experiments in military aviation, Commandant Pollachi, of the Geographical Service of the Army, last September, undertook the task of preparing such maps, with the aid of expert assistants, excellent equipment, and full and accurate information at the command of the French Geographical Service.

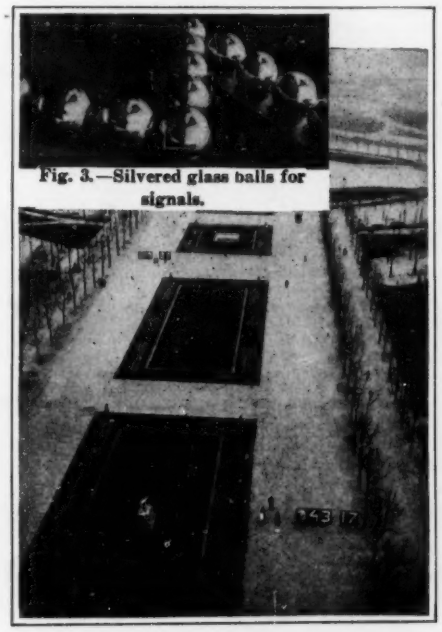


Fig. 3.—Silvered glass balls for signals.

Fig. 4.—The silvered glass ball signals, as seen from the first platform of the Eiffel Tower.

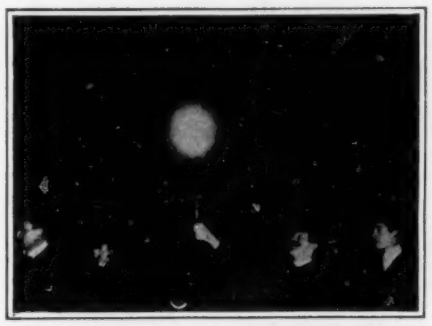


Fig. 5.—Launching a luminous balloon from Aix-la-Chapelle Observatory.

The German general staff had already issued some special aeronautical maps, but, in Commandant Pollachi's opinion, the German maps are overloaded with detail and are drawn on too small a scale (1 to 300,000), and had consequently proved unsatisfactory in the German maneuvers of last year. Profiting by these mistakes, Commandant Pollachi adopted a scale of 1 to 200,000, which permits the introduction of all data useful to aerial navigators, and yet allows a territory measuring 50 by 80 miles to be included in a map measuring 16 by 26 inches.

The first map is already completed, and a portion of it is reproduced in Fig. 7. It is free from all useless and confusing detail, and represents the actual appearance of the country as seen by aviators, as closely as possible, so that it resembles a sort of conventionalized photograph rather than an ordinary topographic map. For example, the highways, which appear to the aviator as long white ribbons, are represented by unprinted strips of fine white paper on the map, bordered by black lines. The general ochre tint of the map resembles that of the ground. Cities, towns and villages are not indicated by the conventional little circles, but are represented by red hatchings of the exact shapes and relative sizes of the real communities. Cathedrals and large churches are indicated by black silhouettes of their main façades, so that they can be recognized at a glance. Solitary trees at cross-roads, windmills, factories, large mansions, monuments and other conspicuous features of the landscape are similarly represented by appropriate and easily recognized figures. Streams, canals, lakes and ponds are printed in blue, and marshes are indicated by blue hatchings, while forests and groves are shown in flat tints of green. Red tints are employed to mark places to be avoided, fine cross-hatching being used for cities and towns, and short, heavy lines, vertical and parallel, for telegraph and telephone lines, vineyards, orchards, quarries, etc. Fortifications are indicated by polygonal scarlet contours, and high voltage electric wires by barbed red lines.

Aviation parks and other favorable landing places are shown in white, and the presence of an airship or aeroplane shed is indicated by a red silhouette of an airship or by that of a rudimentary shed, respectively. The few places where hydrogen can be obtained are indicated by circles.

Railways are indicated by black lines and railway stations by offsets to the lines. Elevations and depressions of the ground are represented directly by shading in bistre and indirectly by numbers indicating altitudes. The mean magnetic deviation of the region is marked in degrees and minutes, and also indicated by an arrow, in the margin of the map.

In Germany a few aeronautical maps have been made

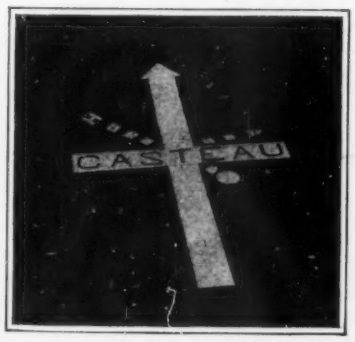


Fig. 6.—The Belgian Cross signal. The point of the arrow is directed northward.

Fig. 9.—Figure-signals by which Farman was kept informed of the distance traversed by him in competing for the Michelin Prize.

Fig. 7.—Portion of a French aeronautical map.

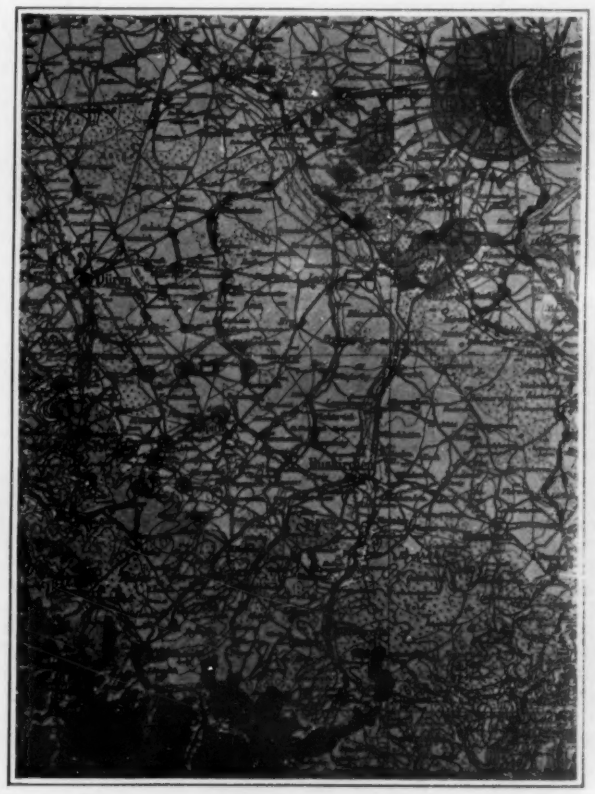


Fig. 8.—German aeronautical map.

THE EARTH FROM THE AIRMAN'S POINT OF VIEW.

by special printings of the maps constructed by the Royal Prussian Land Survey, and it is planned to extend the system over the whole country. The scale is 1 to 300,000, and the elevation of the land is indicated by the ground tint of each part of the map, according to the following scheme:

Elevation in Meters.	Color.
0— 250	white
250— 500	orange yellow
500— 750	raw sienna
750—1,000	burnt sienna
1,000—1,500	lilac gray
1,500—2,000	dark lilac gray
2,000—2,500	dark violet
2,500—3,000	light violet
Above 3,000	white

Contour lines of three types, continuous, interrupted and dotted, printed in sepia, are also used. All information which is needed by aviators and aeronauts and not contained in the ordinary Land Survey maps is printed in red, appropriate symbols being employed to designate various objects.

Albert Senoucque who was a passenger and observer on the Maurice Farman biplane, with which Eugene Renaux won the Michelin Grand Prix by a flight from Paris to the Puy de Dôme, on March 7th, regards a compass as absolutely indispensable for long flights and says that Renaux steered entirely by the compass during the first sixty-five miles of this journey, which began at 8.50 A. M., when even the river Seine was not discernible at any great distance. The compass, of course, should be compensated for the influ-

Fig. 10a.—The roof of one of the military hangars of Camp de Chalons, on which an aeroplane signal is painted.

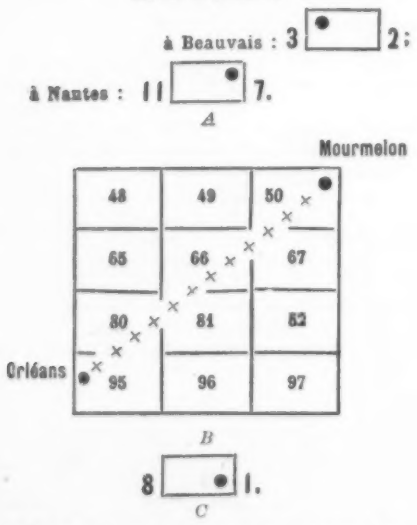


Fig. 10b.—How towns are marked to guide the airman.

ence of iron masses in the aeroplane and should have its outstanding deviations carefully determined, as had been done in this instance.

Daloz has invented a special compass which not only facilitates the task of holding an aerial vessel, traveling overland, to a prescribed course, but also indicates the velocity of flight. The compass card is transparent and bears a number of parallel lines. The circumference is graduated in degrees, the zero marking one end of the median parallel line. The needle is not rigidly attached to the card, but can be clamped to it in any azimuth. The card is set so that the parallel lines point in the direction of the prescribed course and the vessel is so steered that the image of the landscape, thrown on the transparent card by a lens beneath, moves across the card in the direction of these parallel lines. The velocity is determined by means of two lines which intersect these parallels at right angles. From the time which a conspicuous point in the image of the landscape occupies in passing from one of these lines to the other, in connection with the height of the vessel above the ground, as determined by the barometer, the speed of the vessel is easily computed, for the distance between the lines corresponds, in the image, to a real distance of 100 meters, when the instrument is 100 meters above the ground.

Mr. A. G. Marquis, of Rochester, N. Y., has invented a compass with a south-pointing needle and a card which is attached to the frame instead of to the needle, and is marked with the points of the compass in reversed order. When the needle and card are viewed by reflection in a mirror inclined 45 degrees to their plane, the card appears to remain stationary and the needle appears to point in the direction in which the vessel is moving. (SCIENTIFIC AMERICAN, March 4th, 1911.) The oscillations of a compass used in aviation should be deadened by flotation or partial immersion in a liquid, or otherwise, and it is also desirable to protect the instrument from the vibrations of the motor. One aviator uses a compass floating on oil in a vessel which is packed loosely in horsehair.

Two beacons have been installed at Spandaw, near Berlin, for the guidance of aeronauts and aviators at night. One of these beacons is a revolving light provided with a Fresnel spherical lens of 7½ inches focal length surrounded by catadioptric rings, of the type commonly employed in lighthouses. The rays which are emitted directly and obliquely downward are brought above the horizon by a reflector and a series of prisms. The illuminant is acetylene, obtained from the steel cylinders in which it is sold in condensed form. The light is revolved by a turbine operated by the pressure of the acetylene, which passes through the turbine on its way to the burner. The consumption of acetylene is about 8 gallons per hour, and the range of the light is about 10 miles. The range can be doubled by substituting an electric arc and a lens of 12 inches focal length.

The smaller beacon is illuminated by 30 incandescent electric lamps of 50 candle-power each, arranged in six circuits, each of which consumes 6 amperes of current. A triphase current of 220 volts is employed. The light is stationary but intermittent, the circuit being made and broken by an automatic interrupter at intervals of two seconds. The range of the light is about 1,600 feet.

Naval Aviation

By Capt. W. Irving Chambers, U. S. N.

A SHORT time ago, when flights were made in perfect weather only, the navy regarded aviation with complacency. Now that the greater possibilities of flight under average weather conditions have been demonstrated, a majority of our officers are eager to have a hand in the development of aviation for naval purposes, and the fascination of aerial navigation now appeals so forcibly to the spirit of daring in our young officers and men, that our chief difficulty in the future may possibly be so to temper their enthusiasm for flying as to insure the performance of other more necessary and more important duties with the usual degree of efficiency.

I have not the least doubt that these fine young fellows would soon be capturing altitude and other records if allowed to do so, and that to advocate conservatism in aviation now, in the face of its present popularity, will seem almost heretical to them.

But a certain amount of conservatism, at least in the naval branch of aviation, is imperative, and, as aeroplanes are quickly made, it seems to be sound policy for the navy to make haste yet a little slowly until the machines are better adapted to our special needs or, at least, until we have a sufficient number of aviators trained to use them and to measure their efficiency under service conditions.

A conservative policy is evidently that of foreign navies also; but it is known that France has already two naval aviators and one naval aeroplane, that the English navy has two naval officers under instruction through the courtesy of the Aero Club of Great Britain, and that Italy, inspired by some aeroplane experiments recently made here, in conjunction with our ships, is about to develop a suitable machine of the class that we have already evolved in this country.

In fact, although the United States Navy does not as yet actually own an aeroplane, our small beginnings in the development of naval aviation, or the practical efforts that we have made within the last six months have attracted the attention of other naval powers, and we will doubtless soon learn of great advances in the improvement of aeroplanes for naval use generally.

It was only last summer that demonstrations of air flight in this country made it seem probable that aeroplanes could be used from a ship. At that time the principal factor in the general development of aviation seemed to be the stimulus afforded to aviators by substantial money rewards for exhibition flights, and Mr. Eugene Ely deserves special credit for cheerfully and enthusiastically entering into the spirit of naval aviation without the prospect of any reward whatever.

Mr. Ely may be regarded as a pioneer in this branch, although it should be recorded that he might not have been able to attempt his brilliant work under the auspices of any other than the liberal, yet safe, management of Mr. Glenn Curtiss.

It was fortunate for us that one school of aviators was ready and eager to co-operate with the navy; for this connection with the Curtiss school led to a series of progressive experiments that have resulted in the production of a naval aeroplane that is almost perfect.

With this machine Mr. Curtiss is able to arise from or alight on either land or water. He can land on water that is comparatively rough. His "Triad" can be hoisted in and out like a ship's boat and, in accordance with plans already perfected by Mr. Curtiss, we will probably soon be able to launch this machine from shipboard without the necessity for any special platform or the provision of any extra gear that may not be rigged or unrigged in a few minutes.

In my opinion, Mr. Curtiss has recently done more for the development of naval aviation than any other man in the world and he deserves special honor for his liberality and foresight.

The usual policy of aeroplane builders is to make the training of military aviators contingent upon the sale of their machines but Mr. Curtiss early adopted the policy of offering to instruct officers of the army and navy in aviation unconditionally, and it is due to this liberality that the navy is ready, now, to train its own aviators, although the money appropriated for independent work in aviation will not be available until the first of July.

The Wright brothers, of whose work the country is justly proud, have also offered to train a naval aviator, and we anticipate the early inauguration of a systematic course of instruction in aviation, entirely under the auspices of the navy, at our own aerodromes, which for obvious reasons it is desirable to have so located as to be accessible to naval vessels.

I regard the development of the naval aeroplanes, or hydro-aeroplanes (the Curtiss type of which has been named the "Triad" from its triple power to function on any of the three elements, air, land or water) as marking an important epoch in aerial navigation.

If ever trans-oceanic flight by aeroplanes is accomplished, I presume it will be due to the further development of this class of machine. By its use aerial navigation becomes a matter of comparative safety and a means of delightful pleasure trips and sporting events over water.

There is now and always will be sufficient talent in the navy to build its own aeroplanes as well as to operate them and to keep them in the van of progressive aerial architecture. But it is a well known policy of the Department to encourage private industries in the development of war material and, as this policy will doubtless prevail for some time with respect to aeroplanes, I see no good reason for the navy to attempt now to build its own aerial machines. It is hoped, however, that this policy will not prevent the navy from making its own laboratory experiments, conducting its own scientific investigation of the problems of aerial naval architecture and engineering and establishing a sound system of standard tests for workmanship. It is also hoped that this policy will not prevent the navy from eventually embodying, in its standard machines, the best points of all makes that are specially suited for naval purposes.

From my point of view, the principal problem in future flight is the improvement of the motive power. It is the most important because most difficult. Of course, there will be great improvements in the details of shapes and materials and in the assemblage of various other accessories, but we would have been flying fifteen years ago if we could have commanded then the same degrees of efficiency and reliability of the motive power that are at our command to-day. It seems to me, therefore, that there should be some recognized and authoritative government testing or comparing station for motors and propellers in order to make effective progress in their development. Suitable facilities for this work already exist in the navy. The motors and propellers for future naval aeroplanes will doubtless be thoroughly tested and compared, both in the shop and during flight, at the Engineering Experiment Station at Annapolis and at the aerodrome in that vicinity. In this way the navy may be able to assist in the desired general development.

As for laboratory work connected with the test of models and the materials that enter into the architecture of aeroplanes, the government model plant at the navy yard, Washington, is already well equipped for prosecuting scientific investigation in this direction. There we have suitable delicate recording instruments, a corps of expert woodworkers or model-makers and draftsmen under the direction of mathematical experts, and all under the disciplined organization of the Navy Department, ready to undertake the work almost immediately.

I anticipate that, by the introduction of aviation in the navy, we will be able to develop substantial improvements in certain necessary instruments such as the aeroplane compass, for example, and that we

will be able to add something of value to the science of meteorology. Those of us who were brought up in sailing ships realize that our dependence on the wind and weather sharpened our weather instincts. Aerial navigation will doubtless develop in our future naval airmen a yet keener appreciation of weather indications, through their greater dependence on them, and the meteorological observations of these men will doubtless be recorded systematically.

Advanced Study in Electrical Engineering at the Massachusetts Institute of Technology

THE year just completed at the Massachusetts Institute of Technology has found the graduate study which is provided in electrical engineering with an increasing number of students. Prof. Jackson's lectures on the Organization and Administration of Public Service Companies were attended by a class of twelve graduate students and Prof. Pender's lectures on Advanced Alternating Currents and the Transmission of Power were attended by an even larger number of graduate students. Prof. Wickenden's advanced course in the Design of Central Stations and Distribution Systems has also been in demand.

Besides graduating the largest class from the undergraduate course which the Institute of Technology has heretofore graduated in electrical engineering, one degree of Doctor of Engineering and four degrees of Master of Science were conferred on men taking their major work in electrical engineering.

The applicants for permission to become candidates for advanced degrees in electrical engineering are already more numerous than they were last year, and particularly is this true in respect to graduate students who intend to study the problems of electric railroads, electric transmission of power and the organization and management of public service companies.

The Electrical Engineering Department of the Institute of Technology received an appropriation of $3,000 from the Edison Electric Illuminating Company of Boston to be used in an investigation of the relative operating reliability and cost of electric trucks, gasoline trucks and horse trucking, for the purpose of determining to what degree electric trucks are adapted to compete with gas and horse trucks in the city of Boston. This investigation will cover the cost of delivery of goods in the different ways. It will include all questions which concern electric trucks, including the influence of the different kinds of city pavements on cost of delivering goods, and the effects of different routings of the vehicles. The investigation will be partly theoretical but it will be planned to determine practically what it ordinarily costs to deliver goods under city conditions. This part of the investigation will be accompanied by actual observations extended over a period of many months. At least a year will be occupied in this work, and Mr. H. F. Thomson has been appointed Research Associate to carry on the work under the direction of Prof. Pender.

The Current Supplement

CITY life presents pressing and peculiar biological problems. One of the most important is the removing of the city's wastes. By the modern methods of sanitary science, these wastes can be purified and rendered harmless. It is with such methods of protecting the purity of inland and seaboard waters that the opening article of the current SUPPLEMENT, No. 1853, deals.—Prof. Henry S. Jacoby, of Cornell University, writes of recent bridge construction in America.—Dr. L. A. Bauer continues his discussion of Ocean Magnetic Work.—Electric energy is sold to consumers either by contract or at a larger proportion to the current consumed. In the latter case the current is measured by meters. The various meters employed are described and illustrated.—The fifth of Sir J. J. Thomson's Royal Institution lectures on Radiant Energy and Matter is presented.—Major George D. Squier's paper on Multiplex Telephony and Telegraphy, by Electric Waves Guided by Wires, passes to its second installment.

The Microphone and Hidden Water

THE French inventor Dienert has contrived an application of the microphone to the discovery of underground water. One end of a tube is inserted in the ground, the upper end being attached to the microphone. The sounds of flowing or dropping water are conveyed to the ear from great depths.

In the Marne valley two springs were discovered with this apparatus at a depth of about fifty feet below the surface of the ground. It is believed that the apparatus will be of great service in mining operations both for indicating the location of concealed springs and for communicating with imprisoned miners.

Correspondence

The Forthcoming Merchant Marine Number

To the Editor of the SCIENTIFIC AMERICAN:

One of the most noteworthy announcements made recently in your paper is the one telling its readers of the forthcoming (July 15th next) issue devoted to the "American Merchant Marine."

When I read this, a thrill goes through my heart; I feel a disgrace, a humiliation, a sense of shame, never felt before. When I was a boy, in Missouri, some great statesmen told us in school, out of school, and in the press, how the American clipperships were once seen on every sheet of water of the earth, while now we are suffering as a nation after the civil war, but every American heart should hope: *that the future would remedy all this.*

Most of these men, as I now realize, were the old school protectionists, who delighted to believe their own stories and who were then, as their followers are now, disciples of Baron Münchausen.

Yes, Mr. Editor! your July 15th number should prove an awakening, not only among the scientific men of the country, but among all true Americans.

Will this number reveal the actual facts? Or will the facts be colored through Pennsylvania glasses? I hope not! Mr. Munn always stood for the truth and nothing but the truth; such as I have known him for forty-six years. It is the real mission of the SCIENTIFIC AMERICAN to smash the system which caused the destruction of our merchant marine. Every schoolboy, every citizen should learn to detect the fallacies which have been saddled upon this great nation in connection with the merchant marine.

I hope July 15th will be a red-letter day in the history of the American nation. We shall see!

MAX JÄGERHUBER.

Turner, Orange County, New York.

Aeroplane Stability

To the Editor of the SCIENTIFIC AMERICAN:

I anxiously looked forward to the publication of your May 13th or "Aviation Number," and have read your admirable production with great pleasure. Being in the profession of civil engineering, and having had the privilege of lecturing on "Mechanical Flight" at numerous occasions, dating from 1904 to the present year, I have watched closely all articles that deal with the stability and adaptability of the flying machine, as these have been the principal lines of my studies.

Your editorial rightly mentions that the most important element in the flying machine is stability, with the conclusion that we shall ultimately come to a type of a machine which possesses inherent stability independent of devices requiring equilibristic skill of the operator.

Particular attention is given to the late Octave Chanute, his constant endeavors and his advocacy of automatic stability, but to my knowledge he never even offered a theoretical solution for stability.

In Mr. Marius C. Krarup's article, he refers correctly to the present flying machine as "in part a flying machine, and in part a death trap;" and says that "It is without the addition of a single new fundamental idea to supplement or correct its original design." He asks, "What does the engineer say, the man whose profession it is to compare the creations of inventive genius with the data of applied science?" He further states, "Suppose we recommend that inventors work a little harder, and invite imitators to retire from their pernicious activity."

In Mr. Marius C. Krarup's article, he refers cor- "Stability of the Flying Machine," he says that "the common dihedral angle of the two halves of the main planes to each other, and of the main planes to the keel or tail, give a measure of automatic stability that is now widely understood."

Using the above extracts for the basis of this letter, as an engineer I desire to strongly advocate the necessity of serious study by the inventor and engineer for the accomplishment of stability and adaptability of the flying machine, if the universal use of the same is desired. I agree thoroughly with your statements that it is time to stop imitations, and to work on lines that are founded on better engineering principles.

In the first place, the construction of the machine itself undoubtedly can be greatly improved, by following the well-known forms of truss construction, whereby diverging struts should supplement vertical struts as in the present machine, thereby doing away with the cross chords that tie the present structure together, and in a measure hold their separate parts in rigid relationship to each other. The modern tubular steel is admirably adapted for the construction of the flying machine, and to my mind may be used to the exclusion of wooden braces, with their weak joints and connections.

My studies on mechanical flight have led me to design a machine, whereby automatic stability is theoretically obtained by constructing the wings of either side as separate structures, and pivoting them on the central longitudinal line. The wings of the machine during propelled flight would be mechanically held in a horizontal position as with the present machine, having a very slight, if any dihedral angle; but in case of loss of forward propelled motion or stability, the wings would be automatically raised, as in natural flight, leaving the weight of the body and central portion of the machine below the upraised sustaining areas. This would bring the machine to earth in an upright position, with retarded motion. This proposition is of the simplest construction, the shaft of the engine, being the pivotal axis of the wings.

Together with this theoretical solution for automatic stability, I have furthermore advocated the necessity of adaptability, whereby a machine may alight and travel on the water as would a motorboat, or alight on and travel over land, as would an automobile. This may be accomplished by simply attaching below the sustaining areas spherical or cylindrical rotating hollow floats, further eased and made buoyant by being encircled with modern pneumatic tires.

In promoting the art of mechanical flight, an engineer or inventor is handicapped in the development of his ideas, unless he is endowed with the necessary finances for constructing the same; and I find that publications, as well as individuals, make it very hard for one to develop meritorious propositions of this kind, by insisting upon the inventor or engineer proving his theories before the necessary financial assistance is given.

In reference to your list of the $1,000,000 in prizes being offered, I find no prize available for the development of stability and adaptability in the flying machine.

A prize of $25,000, to be handled by the SCIENTIFIC AMERICAN, in the development of that part of the art, would do more for the advancement of the flying machine toward universal use than the entire $1,000,000 offered, as recounted in your issue.

In these experiments calling for construction and practical demonstrations of the theoretical propositions a good rule to follow would be that unless the theoretical proposition could be eliminated by the judges handling the fund, it should receive the assistance of the fund in the construction and demonstration of the machine. J. EMERY HARRIMAN, JR., C. E.

Boston, Mass.

Waterspouts in Nantucket Sound

To the Editor of the SCIENTIFIC AMERICAN:

In the current issue of the SCIENTIFIC AMERICAN I read with much interest the article on "Waterspouts." Nantucket whalemen, returning from long voyages, frequently related thrilling experiences with waterspouts in the tropical zone, but it was not until the summer of 1896 that the islanders themselves had the privilege of viewing one of these phenomena, for it is rarely that a waterspout has been seen in northern waters. In fact, the spout which made its appearance in Nantucket Sound in 1896 is said to be the farthest north of any on record.

This waterspout appeared in the Sound midway between the islands of Nantucket and Marthas Vineyard, near the Cross Rip lightship, on the afternoon of August 19th, 1896, and I have an excellent photograph of it in my possession. The waterspout accompanied an ordinary thunderstorm, and its progress was noted by the Weather Bureau officials on both islands, the data being on record at the Nantucket station. It first made its appearance at 12:40 P. M., when a tongue shot down from a dense black cloud, rising and falling a number of times. Suddenly a second tongue seemed to leap out of the water and joined that hanging down from the cloud. Twice the waterspout parted, but it joined together again almost instantly, the phenomenon continuing in plain sight of the residents of Nantucket and Marthas Vineyard islands for half an hour.

The spout apparently had no side motion, and it was surrounded by a flat calm, extending over a radius of several miles. A small schooner and a catboat were becalmed within a mile of its base, and those on board the vessels stated that the heat experienced was very oppressive. When the spout broke a cool summer breeze sprung up in the Sound, and the surrounding waters seemed to be full of cross currents and "eddies."

Nantucket sea captains who witnessed this phenomenon stated that the spout was the most pronounced of any they had seen, even in the warmer climes. This is the only time a waterspout is known to have made its appearance in Nantucket Sound.

Nantucket, Mass. HARRY B. TURNER.

Sailing the Seven Seas in a "Cockleshell"

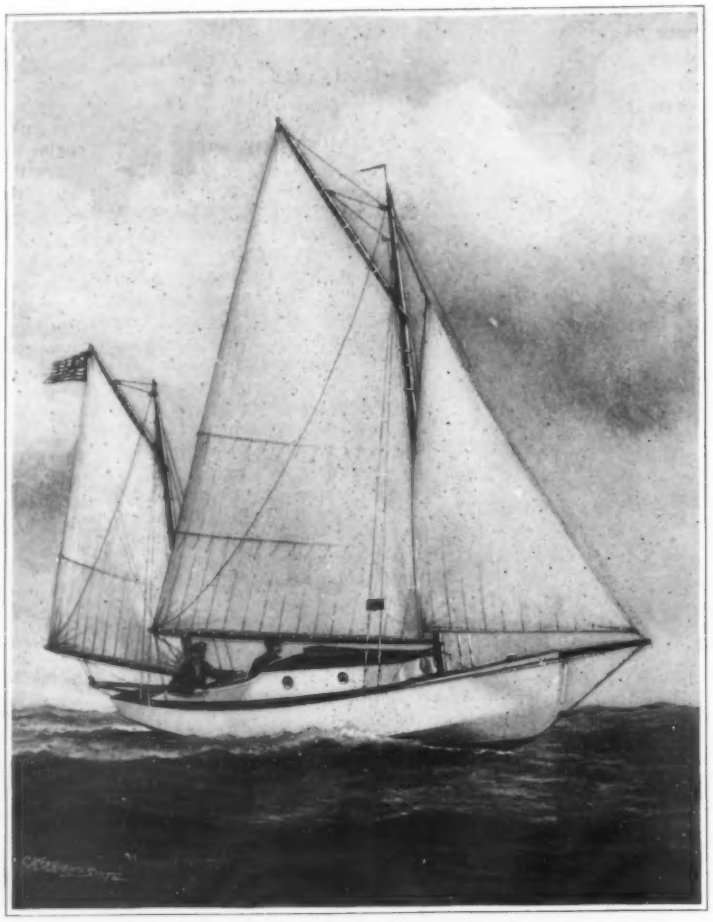
Two Diminutive Yawls Have Dared the Dangers of the Atlantic and Pacific Oceans

BECAUSE of the daring with which their skippers have sailed them out upon broad and deep waters, and braved the perils of storm, fog, and hidden rocks, two diminutive vessels, the "Seabird" and the "Pandora," are now very much in the public eye.

The first of these craft to attract attention, at least on the Atlantic seaboard of the United States, was the "Seabird," a tight little yawl measuring 25 feet 9 inches in length on deck and eight feet in beam, with a draft of the body of the hull of not much over eighteen inches, and a draft to the bottom of the keel of about three feet. At a normal loading the length of the water-line of the "Seabird" is about twenty feet.

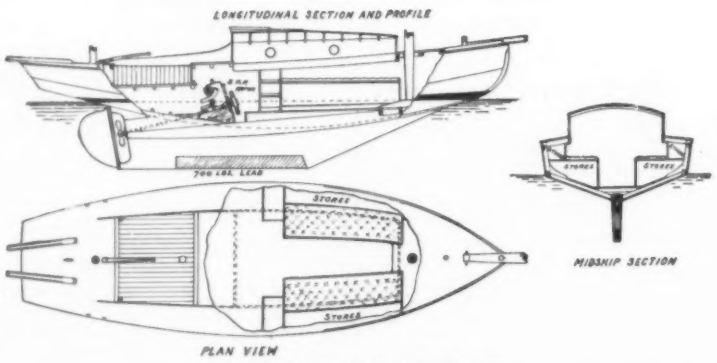
The "Seabird" is one of several designs for small boats which our esteemed contemporary the *Rudder* has published during the past dozen years or so—small, serviceable craft, designed with an eye to comfort, safety, service, ease of construction, and, last but not least, low cost. From these various designs, scores of boats have been built by amateur hands, not merely in the United States, but throughout the world; and, judging from the published stories of their construction and subsequent service, they seem to have been successful and popular. Mr. Thomas Fleming Day, the editor of our esteemed contemporary, the *Rudder*, built a boat from one of these designs as far back as 1901, and named her the "Seabird," and by line and wash drawing our artist has given the SCIENTIFIC AMERICAN readers an opportunity to inspect the craft for themselves. Those of them who are nautically inclined and know something about boats will see that this craft can be easily and cheaply built from such simple materials as can be obtained from the stock of any good lumber yard. In cross section the "Seabird" represents in her under-water body a greatly flattened V, with top sides which rise straight from the bilges, which are at the waterline. The "Seabird" is decked throughout, and the raised cabin roof provides as much head-room as one can reasonably expect in a shallow-bodied boat of this form. There is storage room for spare sails, etc., in the forecastle, and there are two berths in the cabin. The space between the berths and the ship's side and underneath the berths has been utilized for "ship's stores."

The "Seabird" of 1911 differs from the "Seabird" as built in 1901. At that time she had a shallow keel, through which ran a centerboard. As now reconstructed, the centerboard has been taken out and the keel has been lowered until the boat has a normal draft of about three feet. Furthermore, in the bottom of the keel are seven hundred pounds of lead ballast. Another important change has been the installing of a three horse-power motor, which will serve to drive the boat at four knots. Under sail and motor power combined she is expected to make about six knots. The fuel consists of thirty gallons of gasoline and fifty gallons of kerosene. The consumption when power alone is used would be about ten gallons a day; but of course it is intended to use the motor only when there is no wind, or the wind is very light, and, if progress is slow, when the winds are ahead.



Length, 25 feet 9 inches; beam, 8 feet; draft, 3 feet. Carries an auxiliary 3 horse-power motor. Speed, under power, 4 knots; under power and sail, 6 knots.

The yawl "Seabird" in which Editor Day is crossing the Atlantic.



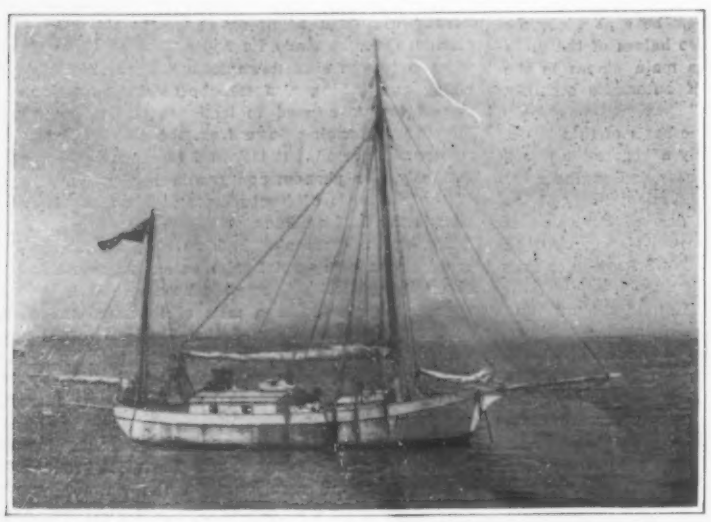
Detail views of the "Seabird."

The "Seabird" is rigged as a yawl, with jib, mainsail, and mizzen. The yawl rig is recognized among yachtsmen and all sailor men as about the most handy and safe for the smaller craft, particularly when they are exposed to heavy weather and sudden squalls. A yawl whose sail plan is well balanced can be sailed under jib and mizzen, or under the mainsail alone. Under storm jib and reefed mizzen, she is a particularly handy craft in quite a strong blow; and if the wind should rise to the strength of a full gale, all sail may be furled, and the vessel handled nicely under a small trysail on the mainmast.

Pubic interest in the "Seabird" lies in the fact that she is now sailing across the North Atlantic Ocean on a pleasure trip, if you please, to Rome. The crew of the little craft consists of Mr. Day and two men, it being the claim of Mr. Day that there is no greater danger for small craft, if indeed as much, in ocean sailing than there is in sailing within sheltered but crowded waters, such as Long Island Sound. He believes that the best Corinthian sailors are found among those who strike boldly out for deep water and learn to navigate by sextant and compass. It is largely due to his influence that long-distance ocean races now form a regular part of the summer schedule of our yachtsmen, both on the Atlantic and the Pacific. Notable among these are the races to Bermuda and those from this port to Marblehead.

Mr. Day has always been a firm believer in the sea-going qualities of the yawl, and the present cruise from Boston to Rome on the Mediterranean, is proof that he has the courage of his convictions, even though his craft is so small that Hudson's "Halfmoon" could have stowed her on deck, and not have been greatly inconvenienced thereby. The course laid out for the "Seabird"

(Continued on page 37.)



The 37 foot 9 inch yawl "Pandora" which is cruising around the world.

The "Pandora's" doughty skipper.

SAILING THE SEVEN SEAS IN A "COCKLESHELL"

Automobile Novelties

A Motor Car for Assayers; Psychological Tests for Chauffeurs

Searching for Mines in a Motor Car

HEREAFTER it will not be necessary for the prospector to undergo the hardships of the trail, for a Los Angeles mining man and inventor has set the pace for the twentieth century search for mines. Mr. H. W. Larsson, assayer, engineer, and practical prospector, has built an automobile which is fully equipped for desert travel, and which will not only enable him to carry the comforts of civilization with him on his quest for precious ore, but also to test his sample within an hour after he finds a promising lead, thus saving much valuable time.

This highly original combination of motor car, Pullman coach, and assay office was constructed entirely from Mr. Larsson's plans, only the wheels being bought in their finished state, and apparently no detail has been overlooked to provide for the comfort of the travelers. There is a reason for this, as Mrs. Larsson is now accompanying her husband through the southwestern desert. The housekeeping equipment is exceedingly compact.

A table folds up against the wall, and when it is let down discloses a small kitchen cabinet and triple cooking outfit, while lockers, china closet, larder, and medicine chest are so arranged as to take up the least possible room. Two 20-gallon tanks of water are carried, and that used for drinking purposes runs through chemically-cooled pipes and is delivered ice cold. The water faucet and glass are conveniently arranged near the driver's seat. This seat, by the way, is reversible, so that at the meal time it can be made to face the dining table instead of the front of the car.

The engine is connected with a dynamo which furnishes electric lights for the little home on wheels. Two comfortable berths are arranged so that they can fold up against the wall when they are not in use, and a kind of folding chiffonier is provided for wearing apparel.

The automobile is equipped with sliding glass windows and green curtains which insure privacy, while a row of small ventilators extends all the way around the car directly under the roof.

So much for comfort. From the utilitarian standpoint, Mr. Larsson's plans are no less thorough. From his own model was constructed a three-cylinder, two-cycle engine with double friction drive of a proved 33 horse-power. This carries the car along at a rate of sixteen miles an hour, which is ample speed for his purpose. It also furnishes the power for the electric lighting plant and the ore crusher which grinds his specimens to the fineness of 100 mesh.

The complete ore-testing equipment consists of a rotary flame combination furnace with Cary burner and tank outfit, a Braun pulverizer, and a steel frame Chipmunk crusher.

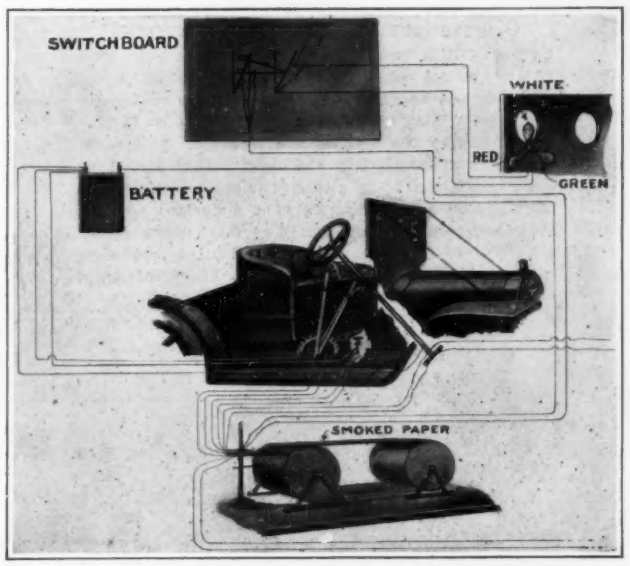
These are all in miniature size, but of course do the actual work required for the prospector, and in addition to this they can be used to demonstrate the efficiency of the same outfit on a large scale, so that in one sense this up-to-date prospector might be called a traveling salesman for the manufacturers of these machines. This, however, is a side issue, and merely indicates how far the modern prospector has departed from the ways of the former generation of burro packers. Four tanks of gasoline are carried, each of ten-gallon capacity. The general appearance of the car is very attractive without being ornate. Its dimensions are, length, 13½ feet; width, 4½ feet, and height, about 7 feet.

In addition to his mining work, Mr. Larsson intends to do an excellent service to his fellow prospectors and desert travelers in marking the trails to water holes along his route. He will also place guide posts indicating the number of miles from the various camps, and the distance will be accurately determined by his speedometer. The metal guide posts, 250 in number, were supplied gratis by F. W. Braun of Los Angeles, and will do much to mitigate the hardships of the trail.

Psychological Apparatus for Testing Chauffeurs

By Ralph Bergengren

ALTHOUGH no definite relation has yet been established between the operation of statute law and the experimental study of human beings by the psychologists, many experts in both fields are coming more and more to believe that psychology will play an important part in legal procedure during the present century. Practically the psychologist has so far taken no part in legal proceedings. But he has invented apparatus that can detect the hidden emotions of a witness far more certainly than any unaided cross-examination and that will force the truth from a suspected criminal, without cruelty if he happens to be innocent and with an absolute precision impossible in the ordinary methods of police interrogation. To record and measure the hidden feelings of an individual in regard to any given subject is evidently more reliable a way of getting at facts than to ask him questions without any definite method of determining the truth of his answers. Herein, it is argued, lies the future of psychology as a practical first aid to law and order.



PSYCHOLOGICAL TEST APPARATUS FOR CHAUFFEURS

The latest example of psychological apparatus that might be applied to the routine business of a municipality is a mechanism devised by Mr. Charles Sherwood Ricker, of the Department of Psychology at Harvard University, for the purpose of testing the reaction-time of the man behind the steering wheel of an automobile. A reaction-time, in psychology, is the exact space, measured in fractions of a second, necessary for a given individual to receive a given impression and perform the actions suggested by it. Applied to criminal investigation, for example, the criminal, being asked any question that suggested his crime, would answer that question by an infinitesimal fraction of a second more later than he would answer questions without such connection. Whatever his control over his features, he would be unable to prevent this infinitesimal slowing up of the mind when the crime was recalled to him. And so, when applied to the problem of individual capacity to run a motor car, the psychological apparatus gets down to conditions that no amount of verbal examination could possibly arrive at. Legal qualifications for handling a motor-driven vehicle vary at present in the different States. The severest requirement demands that the applicant for a license shall prove that he has driven such a vehicle at least one hundred miles. Among the questions most generally asked of such candidates, three are almost universal: Do you habitually use, to excess, intoxicating beverages? Have you any mental or physical incapacity or infirmity which would interfere with your management of an automobile? Have you ever been convicted of any offense against any laws in relation to the use of automobiles on public highways?

One hardly needs be a psychologist to see that neither the mere negative answer to these questions nor the fact of his having driven an automobile over a hundred miles proves that an individual should be trusted to run a motor car. Candidates are unlikely to admit, or even believe, that they ever use intoxicating beverages to excess. Physical infirmities that may result in motor accidents may also be entirely unsuspected by their possessor. The third question has little bearing on the capacity of the individual to run his car, although it may show his attitude toward the law. And the hundred miles over which he has driven a car may easily have been a hundred miles of open country road and no test whatever of what will happen when he meets some sudden emergency in a crowded street. The really important question is not what the candidate has done, but what he is likely to do under the most sudden and unexpected emergencies. No man, unless he has long experience with emergencies, can tell how quickly and efficiently he would be likely to meet a new one. But the psychological apparatus devised by Mr. Ricker answers this question by bringing the man suddenly face to face with the emergency and measuring the time it will take him to meet it with the various controls of his motor car.

REAR OF CAR, WITH ORE CRUSHER IN OPERATION

The apparatus consists of a device for signaling the emergency and another for recording the reactions of the motorist. A dummy motor car is provided with the regulation steering wheel; the side throttle that controls the different speeds; the foot clutch whose release throws the machinery of the car immediately out of gear, and the emergency brake. In place of the ordinary wind shield the psychological motor car has an opaque screen with three openings, and in front of the screen are three electric bulbs invisible to the chauffeur except when one or the other of them suddenly glares at him through an aperture. These bulbs, white, green and red, respectively, are so arranged that they may be revolved in front of the openings in the screen by means of an electric push button under the finger of the psychologist conducting the experiment. Outside the car, or in the tonneau of a real automobile, if the tests were being made on the road, is a cylinder of smoked paper which revolves steadily and is in contact with the end of a tuning fork and almost in contact with four little metal pointers respectively connected by an open electric circuit with the steering wheel, clutch, throttle, and brake.

Pressure on the push button that flashes one or another of the electric bulbs in front of the chauffeur sets the cylinder, or time clock, in motion, and the tuning fork begins tracing a sharply scolloped line on

(Continued on page 38.)

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

The British Naval Airship

AT last the British leviathan of the air has emerged from the interior of its hiding place into the full light of day. And it *is* an immense dirigible, too, indeed the largest in existence. Over 170 yards long, no less than 16 yards in diameter. According to *Flight*, "it has a gas capacity of 700,000 cubic feet, a lift of 21 tons, its engine power is no less than 400-horse-power in two equal units formed by Wolseley engines. It can carry twenty-two persons and has cost up to date the sum of $205,000. More than an acre and a half of Continental fabric was employed in the construction of the envelope, and the hydrogen, compressed in cylinders, was brought over from Wolverhampton by the train load at a time.

"During two years this airship has been in course of design and construction, and the lines on which it is built are broadly similar to those of the famous Zeppelin airships that have created so many sensations in Germany. We will at least hope that the English vessel will be more fortunate. Its constructors are the great firm of Vickers, Ltd.

"The characteristic feature of the type to which it belongs is the rigidity of its envelope, which has an interior skeleton framework made of duralumin, the new light aluminium alloy. This frame-work maintains the shape of an envelope, which is thus not dependent on the gas pressure as it is with airships of the non-rigid type that are intended to be capable of being folded for transport by land.

"Inside the framework of the envelope are seventeen ballons filled with hydrogen, each balloon forming a separate gas-tight chamber of its own, and if deflated by accident would not affect the others. Outside the framework is a covering of fabric, the appearance of which is somewhat distinctive owing to the upper part being silver-gray and the lower half yellow in color. The upper part is as far as possible a non-conductor of heat, and thus minimizes the effect of the sun's rays on the expansion of the gas. The lower part, on the other hand, is a conductor of heat and thus facilitates the proper equalization of temperature between the gas and the atmosphere to be carried on in a normal manner.

"In accord with the most modern theories of streamline form, the envelope is cylindrical in the middle, with tapering extremities. The nose is blunter than the tail. On the tail of the envelope or hull, as it may be termed because of its rigidity, are the directive organs, consisting of four stabilizing fins (two vertical and two horizontal), two sets of quadruplane rudders, and two sets of triplane elevators. There is also an elevator under the bows, and another rudder right under the stern, these latter being both situated near to the cars. Beneath the hull are two 20-foot cars or boats joined by a gangway. In front, the engine drives two four-bladed propellers, carried on outriggers beneath the hull; at the stern there is a single two-bladed propeller.

"Water ballast is employed, and the estimated speed of the airship is 40 miles per hour. For mooring purposes the bows of the airship are anchored to a mast rising from a kind of raft, which also carries a great net screen like a sail. The mesh of this screen is sufficiently close to break down the force of the wind without being itself torn away in the process, and the anchorage is such that the airship and its screen can veer round so as to keep head-on to the wind. The airship is in charge of Capt. Sueter, who has under him Lieuts. Usborne and Talbot. The parent ship to which she is attached is the cruiser 'Hermione.'

"It took 300 bluejackets less than an hour to haul the airship out of her shed and get her safely moored in Cavendish Dock in the early hours of Monday morning, May 22nd. To be precise the performance commenced at ten minutes past four, and was all over long before most people had waked from sleep. One of the most striking sights in connection with the launch was the sudden appearance of sailors on the very top of the envelope, where there is a prepared gangway, and access to which is obtained by means of a rope ladder through the center of the envelope itself."

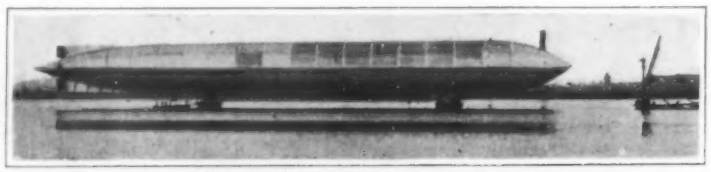


Fig. 1.—The ship and her moorings.

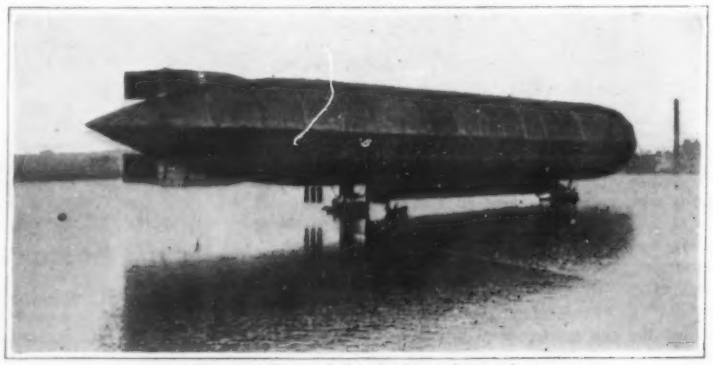
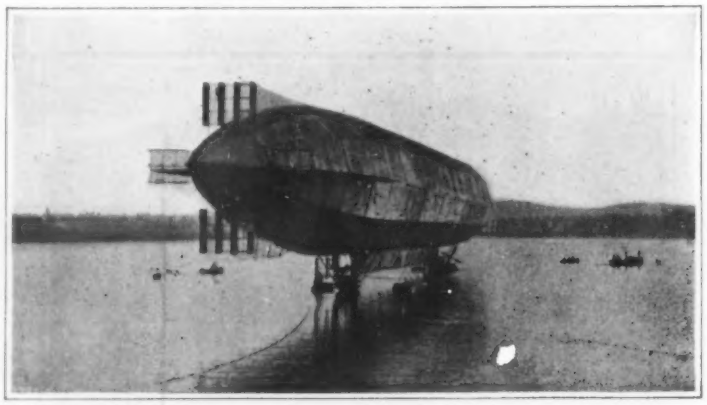


Fig. 2.—View of ship looking forward.



By courtesy of *Engineering*.

Fig. 3.—The stern of the ship.

THE NEWEST OF DIRIGIBLES

Observations on Scientific Management

"MODERN watches are marvels of intricate and perfect construction," says Mr. Harrington Emerson, the efficiency engineer, in the *Engineering Magazine*. "Any child can push a stick in the ground and by the position and length of the shadow determine approximately the time. A clepsydra or water clock, an hour glass, physical material leaking away at a uniform rate, was a decided advance at guessing on the time in the dark, or the time for boiling an egg. The early clocks with their pendulum escapements required many months of experimental test before length of pendulum, meshing of wheels, amount of weight, were adjusted to one another. There are as many different kinds of watches and clocks as there are locomotives; but each is perfect with a perfection so great as to be almost inconceivable. The jewelled bearings, the almost microscopic yet mathematically perfectly shaped teeth of the wheels, the hair spring, the balance wheel, each is perfect in itself, perfectly related to the others, until the whole is also perfect. This is not all. Delicate, automatic machines are made which turn out these perfected parts so exactly alike as to be interchangeable. Turret lathes and screw machines, automatic machines in general, were earliest adapted to clock and watch making, and from that extended to larger and heavier parts, often beyond the point of economy; for in watch screws the material, even if of gold, would not amount to very much, the perfection of finish being all important, but as the weight of material grows with the cube of its linear measurement, we cannot afford to make on automatic machines crank pins or even knuckle pins for locomotives, it being too expensive to cut down the solid bar.

"It would take no more thought and work to standardize operations for building a locomotive than for building a watch. The difference is that watches are turned out by the hundred thousands and locomotives only by the thousand; but this difference is not as great as it seems, for a watch movement may average $5 in value and a locomotive $15,000, so that one locomotive corresponds to 3,000 watches, and we have not hesitated to undertake the work of designing each separate locomotive part, we need not fear the labor of standardizing the operation of manufacture for each separate locomotive part.

"Another instance of standardized operation is the printing of a book. The old writers were individualists; there was no standardized operation. Each made not only the size of the letters to suit himself, but also their forms, took pride in not being like other scribes; each spelled the words his own way, each used his stylus or brush as he preferred, preparing his own ink, his own papyrus or parchment. Now we buy half a dozen newspapers a day for a cent each, we buy a dozen magazines a week for 10 cents each, we buy a hundred books a year for a dollar or two each. Scarcely any two books are alike; there is far greater variation than in locomotives or watches; but each book is made up and printed with standardized spelling, standardized lines, standardized pages and standardized signatures; even the book itself approaches a standard in size. The ink is made to suit various fluctuations in the weather, the paper is made to suit the quality of the book in press. While printing is as yet standardized in a rudimentary way only, while it affords a field as large as any manufacturing business in the country, it has nevertheless in certain limited directions standardized operation to an advanced extent.

"In the watch, in the book, we have the standardized operation as to the manner in which it shall be carried out; but there is another element—that of individual skill.

"Two men may both show a model wall of brick, yet one man may have laid 3,000 bricks a day, the other man only 300.

"'So true it is that one man and one intellect properly qualified for the particular undertaking is a host in itself and of extraordinary efficiency.' Thus wrote Polybius, 212 B. C., in describing the work of that great engineer Archimedes, who, by his individual genius, flung rocks from catapults at the approaching besieging ships, who constructed cranes that let down grab hooks, lifted the ships out of the water, and turning them over, let them fall to destruction.

"Horses have trotted and trotted well for many centuries, but it remained for Americans to figure out that the value of a minute might be rated at $3,000,000, and that to eliminate the minute, to evolve the mile-in-two-minute horse from the mile-in-three-minute horse would be worth this amount. Prizes were offered to crack trotters for beating their own record, $10,000 for the fifth of a second, and there are 300 fifths in a single minute. It was not only the horse that was developed; it was also the American stop-watch spirit, so that our fire fighters, whose every movement for men and teams has been standardized, are able to charge across the threshold of their fire-house 20 seconds after the gong has sounded.

"At an international contest in Berlin several years ago it took the English team over two minutes and the German team over eight minutes to make a start. This is quite a contrast as compared with the American performance.

"Now aeroplanes have come; and at the international meet in Belmont, true to our national virtues and our national faults, we were prepared to time the flights to the hundredth part of a second, but with a year's warning we had no machines wherewith to fly and we lost to the foreigners because we were unprepared."

The Movement of Soil Material by the Wind

UNDER the above title the United States Bureau of Soils has just published, as its Bulletin No. 68, a monograph by E. E. Free, which, including an enormous bibliography of æolian geology by Messrs. Stuntz and Free, comprises 272 octavo pages. This work brings together, correlates and summarizes practically everything known in regard to æolian geology, so far as that subject concerns the student of soils.

While the activity of the wind as a geologic agent has long been fully recognized, its action on the soil has not heretofore been adequately treated as an agronomic problem. It is, however, a most important factor in the complex system of soil movements affecting soil fertility. The soil of any particular farm or field is continually changing under the action of the wind. This action, when moderate, is beneficial to fertility; when excessive, it is one of the serious obstacles to successful agriculture, and must be controlled by various expedients, such as windbreaks, cover crops, rotation schemes, etc. This matter is important not only to the tiller of the soil, but also to the builder of railways and highways, the irrigation engineer, and many others.

Such is the important economic problem that Mr. Free has undertaken to discuss, but he has far exceeded his theme, and has produced a memoir replete with interest to the physical geographer, the geologist, and the meteorologist; for his work is a digest of existing information concerning the solid content of the air; its composition and sources, the mechanism of its transportation; and the many effects of its removal from and deposit upon the earth's surface. The scope of the work may be judged from the following principal headings in the text: Heterogeneity of soils; translocating agents in general; the limitations of water translocation; wind translocation; the mechanics of wind translocation; drifting sands and sand dunes; dust storms and dust falls; the continual drift of soil material with the wind; true atmospheric dust; geologic formations of æolian origin; volcanic dust as soil material; wind transport of vegetable matter; translocation in general; excessive blowing of the soil.

In one respect, in particular, Mr. Free has set an admirable example to the writers of scientific monographs. His text is supported at every step by copious and well-nigh exhaustive references to the sources of his information. These references number many thousand; so that under each topic discussed the reader will find a complete bibliography of the same; and the references are repeated in an amplified form, alphabetically arranged by authors, at the end of the book. As a contribution to scientific bibliography this work is almost unrivaled among recent official publications; while the text is an invaluable summary of the immense body of literature upon which it is based.

The Prevention of Malaria[1]

AMONG the most striking successes which preventive medicine has achieved in recent years is the very extensive subjugation of malaria as the result of the recognition of a certain breed of mosquitoes as the carriers of the disease. The subject, on which there is now considerable literature, has been treated in collective form in a hand book recently published by Prof. R. Ross, and reviewed in a late issue of *Science Progress*. The reviewer, E. A. Minchin, says in part:

"Prof. Ronald Ross, poet, mathematician, and apostle of tropical sanitation, gives us in the first half of this book the fruit of twenty years' research and experience with regard to the causation and prevention of a disease which, on his estimate, causes 'between a quarter and a half the total sickness in many tropical countries.' The remainder of the book consists of reports from those who have put Ross's principles and methods into practice in every part of the globe; their results afford a brilliant testimony to the immense value to humanity of the modern discoveries regarding the etiology of malaria, a subject in which Ross himself led the way and broke entirely new ground.

"The aims and objects of this book are essentially practical and utilitarian; it is intended to set forth concisely and in a form popularly intelligible the relevant facts concerning the natural history and causation of malaria, in order to show clearly how the disease may best be prevented and eradicated. It is, in short, a manual of instruction for medical men, sanitary officers and administrators upon whom may fall the task of combating malaria in some part of the globe. For this reason the more purely scientific aspects of the malarial problem, such as the marvelous and complicated life history of the parasite in its two hosts, vertebrate and insect, are dealt with as briefly and simply as possible.

"The malarial theorem, as Ross aptly terms it, may be stated briefly as follows. Malaria in man or animals is a disease caused by a minute parasite which lives and multiplies in the blood, passing its trophic phase within the red blood corpuscles. The parasite is propagated from one vertebrate host to another by the agency of certain mosquitoes, which, on sucking the blood of an infected vertebrate, take various stages of the parasite into their stomachs with the blood; one stage of the parasite resists the action of the digestive juices of the mosquito and passes through a sexual process of generation and multiplication within the body of the mosquito, the cycle ending after some days with the production of many thousands of minute germs ('protospores,' Ross) lodged in the salivary glands. If the mosquito then succeeds in biting a vertebrate of the right kind, that is to say, of the kind which is a specific host of the parasite in question, the germs pass down its proboscis and are inoculated into the blood, thus bringing about a fresh infection of the disease. Every statement made in the foregoing sentences is based on rigorous experiment or accurate microscopical investigation. It only remains to add that the various species of malarial parasites are specific to certain hosts, vertebrate or insect; those of birds, for instance, can only be transmitted by mosquitoes of the subfamily Culicinæ; those of men only by the subfamily Anophelinæ.

"The principles of malarial prevention depend on the facts stated above; their aim is to interrupt the complex chain of circumstances upon which the existence of the parasite depends. If the parasite cannot pass from man into the mosquito, or from the mosquito into man, it becomes extinct with the death of its host, if not before. Hence there are three general principles of prevention: (1) *mosquito-reduction*, that is to say, measures undertaken with the object of destroying mosquitoes or their aquatic larvæ, or of abolishing or reducing the pieces of water suitable for them to breed in; (2) *treatment* of human beings with quinine, either with the object of reducing the cases of sickness, or in order to enable the healthy to resist infection, should they chance to be bitten by an infected mosquito; (3) *protection* of human beings against mosquitoes by various methods, especially by rendering houses proof against these insects. Any of these three methods is sufficient to extirpate malaria completely, if carried out thoroughly. If, in a given locality, the Anopheline mosquitoes are exterminated, or if there are no infected persons for them to bite, or if they are prevented from biting human beings, the disease cannot continue. But in practice it is always impossible to carry out any of these methods completely and it is necessary to rely upon a combination of the three. The best results are always obtained by mosquito-reduction, since it can be effected by administrative regulation, while treatment and protection depend mainly on individual effort—always difficult to control or enforce.

"Such are, very briefly, the main aspects of the problem of preventing or extirpating malaria; but many pages are required to set forth the intricacies and complications of the question.

"Turning to the second half of the book, it is impossible to give in a brief space an account of the many anti-malarial campaigns in all parts of the world that are described and reported upon by twenty-one different writers. It must suffice to state briefly the results obtained in Ismailia, that most striking example of the practical importance of Ross's researches and of the efficacy of his methods, as set forth by Mr. H. C. Ross.

"The town of Ismailia was founded by M. de Lesseps, who intended it to be a model city, a thriving port and the headquarters of the Suez Canal Company. It progressed rapidly, rising to a population of 10,000, until in 1877 malaria made its appearance, 300 cases being notified in that year. From 1885 to 1902 the number of cases annually was seldom much below 2,000, and in 1891 it rose to over 2,500, more than one-quarter of the whole population. In 1902 an anti-malarial campaign was started under the auspices of Prof. Ronald Ross, directed chiefly toward the extermination of the mosquitoes. A marsh near the town was drained; pools were filled up and a mosquito brigade was organized consisting of a European foreman and two natives. The duty of the brigade was to visit every house once a week, to treat the cesspools with petroleum, in order to kill the mosquito larvæ; to empty all standing vessels or tubs containing water, and to clear all irrigation channels of reeds, so that the water could flow swiftly. Penalties were imposed on the inhabitants if they did not report to the authorities the existence of untreated collections of water. The work cost $10,000 the first year and about $5,000 a year subsequently. For this relatively trifling outlay the most remarkable results were obtained. The number of cases of malaria fell at once, in 1903, to 300; in 1904 there were 90 cases; in 1905, 37; since then no fresh cases of malaria contracted in Ismailia have occurred; the disease is stamped out. It is necessary, however, to continue the preventive measures, since if the mosquito brigade stops work for a week the mosquitoes return; and there is always the danger, in that case, of a recurrence of the epidemic through infected persons from without coming into the town.

"Nothing shows more clearly than the case of Ismailia the possibility of combating malaria effectually in any locality if anti-malarial measures, especially that of mosquito-reduction, be carried out rigorously. The failure to obtain similar results by similar methods in other places must be ascribed mainly to the obstacles which stand in the way, of which the chief are ignorance and blind resistance to administrative efforts on the part of the people, or official apathy and parsimony on the part of the government classes." Prof. Ross speaks out strongly on these subjects, as he has done frequently before. It is to be hoped that this book will be widely circulated among medical men and administrators in the tropics, and that it will lead to a proper understanding of the measures to be taken against one of the greatest obstacles in many lands to civilization and progress.

[1] *The Prevention of Malaria.* By Ronald Ross, K.C.B., F.R.S., Nobel Laureate, with Contributions by Prof. L. O. Howard, Col. W. C. Gorgas, and others. [Pp. xx + 669.] (London: John Murray, 1910.)

Visual Sensations from the Alternating Magnetic Field

FOLLOWING on the experiments reported by Prof. Silvanus P. Thompson, it is interesting to note the further research in this subject pursued by Mr. Knight Dunlap, an account of which appears in a recent issue of *Nature*.

"Prof. Thompson subjected the head to the influence of an alternating magnetic field, which was obtained by means of a coil of thirty-two turns of stranded copper conductor having an internal diameter of 9 inches and a length of 8 inches. The coil was supplied with a current the maximum value of which was 180 amperes at a frequency of fifty cycles per second.

"On inserting the head in the coil under these conditions, a flickering light sensation was obtained, the sensation being more clearly defined in the peripheral part of the field of vision.

"The object of the further experiments by Mr. Dunlap was to ascertain whether or not these sensations were due to idio-retinal light, under the suggestion of the hum of the coil caused by the alternating current.

"A coil was constructed which gave a field of approximately the same density as that obtained by Prof. Thompson, and identical results were observed.

"In order to ascertain whether the effects are due to idio-retinal light and suggestion, some experiments were carried out in which suggestion was eliminated to the fullest extent.

"In these tests the transformer was placed near the coil, so that the hum of the coil was completely drowned by the noise of the transformer. Arrangements were made whereby the current could be switched from the coil on to a resistance, the strength being maintained constant.

"The subject's ears were plugged up, and a telephone receiver connected to the transformer was hung on the coil.

"Under these conditions it was absolutely impossible to tell by the sound whether the current was on or off the coil; each of the observers was able, however, to identify the flicker with absolute precision when the current was switched on to the coil.

"With a field alternating at a lower (twenty-five cycles per second) frequency, it was found that sensation was much more pronounced and intensely disagreeable, the whole visual field quivering as if illuminated by a rapidly intermittent light.

"The effect was at all times very intense when the side of the head was presented to the coil, but on looking into the coil it practically disappears. From this Mr. Dunlap infers that the sensation is due to currents induced in the optic pathway; he states that whether these currents excite the occipital cortex directly, or excite the retina primarily, is a matter for conjecture; the fact that the flicker is produced by alterations faster than the fastest flicker from normal light stimulation being, it is stated, no evidence for the non-retinal character of the flicker in question.

"It is stated that there was no evidence to show that there was a definite arousal of visual sensation by the alternating field; the effect appeared more like an alternate intensification and inhibition of whatever sensory process was already in progress. That is to say, the idio-retinal light which is present before the current is turned on is increased and decreased alternately."

[The Editor of Handy Man's Workshop will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

A Dangerous Muffler

To the Editor of Handy Man's Workshop:

IN Handy Man's Workshop of June 10th there is a description of a muffler for gasoline engines, which may work all right and certainly will be a good silencer so far as the noise from the exhaust is concerned; but some day the engine will get to missing fire—they all do it some time—and then the unburned gases will be forced from the engine into the barrels. This may continue for a time and then a weak charge in the engine will be fired and the fire will be communicated to the unburned gas in the exhaust pipe and from that into the barrel and away will go the barrel as if a large charge of powder had been exploded. I have long known of the danger in such cases. Only a few years ago a party had an engine in one of the buildings I now own, and had placed a large box under the flooring into which the exhaust from the engine went, passing thence to the outside. Then the batteries became weak and the engine began missing, and a little later the gas in the box exploded. It tore up about 15 feet square of floor and broke nearly every glass in the lower story of the building, 24 by 60, and did a lot of other damage. It hurt one workman considerably, but did not kill any one, which was considered very lucky. H. L. CHAPMAN.

Marcellus, Mich.

A Good Substitute for a Drill Post

By R. C. D.

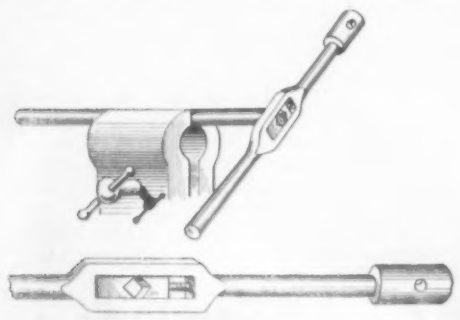
THERE are times when one is in a quandary as to the best way of setting up a drill post or "old man," as it is sometimes called. This is particularly true when one has nothing but a curved surface on which to attach the base of the post. To overcome this trouble when holes are to be drilled in cylindrical objects such as metal posts, poles, boilers, etc., one may use a chain attached to a metal plate shaped as shown in the accompanying illustration. This plate has hooks forged or attached to its ends as shown, and to one of these one end of the chain is permanently secured. The other hook is made just large enough for the links of the chain to pass over it freely. In this way the device is made adjustable on objects of various sizes. The method of using the device in connection with a ratchet drill is clearly shown in the illustration.

Substitute for a drill post.

Reducing the Size of Tubing

By F. C. I.

IT often becomes necessary to reduce the size of copper tubing so that it will enter a connection which does not admit of being reamed out to a larger size. If the tubing is filed down to fit it weakens the connection. The tubing is easily and neatly reduced by means of a tap wrench, which is placed over the end and tightened as it is rotated. The tap wrench should be tightened gradually, or it will crimp the tubing.

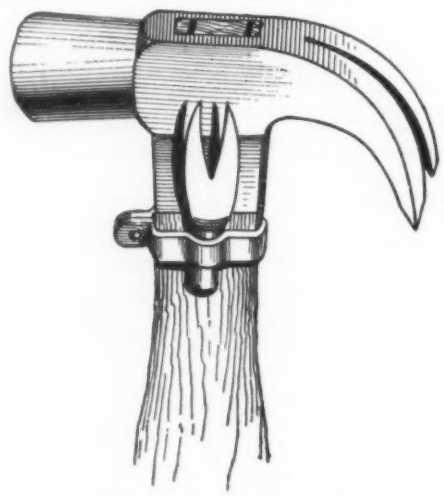


Reducing a tube with a tap wrench.

Nail-holder for Claw-hammers

By W. J. C.

THE accompanying illustration is almost self-explanatory. A tongue of metal shaped as shown with a V-shaped slot in the upper half in clamped on to the handle of a hammer just below the head with an ordinary hose clamp. The V-shaped slot should be held slightly away from the flat side of the hammer.



Nail-holder for a hammer.

When it is desired to drive a nail in a location where both hands can not reach, for instance, above the head or to the right or left, when standing on a ladder, the nail is placed in the slot, with the head against the hammer head and the point extending to the side. A sharp blow starts the nail, and on withdrawing the hammer, the nail can be driven home.

Centering and Reboring Engine Cylinders in a Lathe

By H. C. Urbaner

TAKING for granted that our friend wishes to rebore cylinders in an ordinary lathe, I think he will find the following simple method very helpful.

First, fit a hardwood block (2 by 4 preferred) into each end of the cylinder so that it will hold a rigid position. Now take a pair of hermaphrodite dividers and accurately fix a center into these blocks. Then with a three-quarter inch drill, or an inch drill, bore holes through these blocks at the centers described so that they will be in line with each other. Now fit a rod through these blocks so that it will extend far enough out of each end of the cylinder to meet the lathe centers without interference of projections of the cylinder. Here I may state that the centered blocks alone will be sufficient on a cylinder having both ends fitted with a head.

Next lay the cylinder on the slide rest and with hardwood blocks, if iron blocks are not available, block it up until the centers previously made in the rod will be accurately in line with the lathe centers, when the cylinder is lightly bolted and clamped to the slide rest. This is the all-important step of the entire process, and must be done accurately with whatever material there is at hand.

Now for a boring bar. This bar should be of round steel shafting and sufficiently longer than twice the length of the cylinder so that while doing the work the cylinder will not strike the dead or live centers of the lathe.

It should be at least two and one-half or three inches in diameter so as to remain rigid. This bar is fitted with the cutting tool a little farther than the length of the cylinder from the dead center end by boring a hole through it and filing it out so that it will admit the cutting tool. The tool should be at least one inch wide and preferably five-eighths or three-quarters of an inch in thickness. This tool may be held in place by fixing a setscrew at right angles to the tool through the bar.

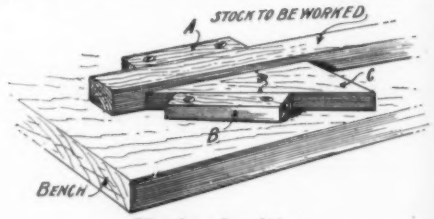
In the boring operation the lathe should run at slow speed and the cylinder on the slide rest fed to the cutting tool in the usual manner. But under no circumstances should the lathe be stopped until the tool has cut the full length of the cylinder. If it is, you are sure to have a little bump, or a depression. In reboring a cylinder it is always best to take two light cuts—one through and the other back with the same tool, the rear end of the cutting edge of which is slightly relieved so that when coming back for the second cut it will leave a smooth surface.

[This is a second answer to the problem published in the SCIENTIFIC AMERICAN of May 6th. The other answer was published in the issue of June 24th.—ED.]

A Simple Vise

By B. Francis Dashiell

THE accompanying engraving shows a very handy and easily made vise or clamp. At *A* is a piece of dressed hardwood 12 inches by 2 inches by 1 inch. It is screwed upon the bench or table top. Another piece *B* of the same dimensions is screwed on about



Vise for a bench top.

8 inches away and at an angle of 30 degrees to *A*. A triangular piece *C* with its hypotenuse about 15 inches long is used as a wedge.

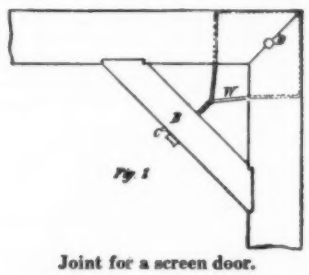
The stock that is to be worked is placed up against the piece *A*, and the wedge *C* is driven up tightly, thus clamping the stock firmly.

Some Oddities in Joints

By W. D. Graves

VISITING a friend, the writer's attention was engaged by a number of jointures which, while they would hardly appeal to the operator of a fully equipped wood-working plant, are all thoroughly practical—however odd—and might well be used by any one lacking the equipment necessary for the expeditious making of more conventional ones.

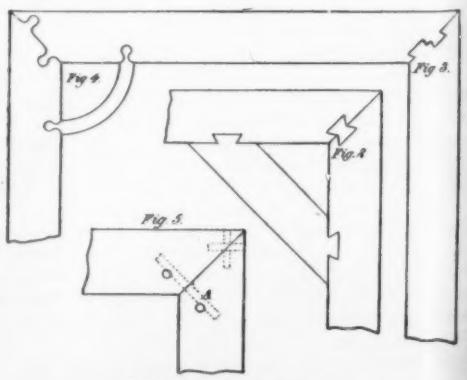
That shown in Fig. 1 was in a screen door corner, and was very secure. The stock was mitered, a wire *W* carried around the corner, through holes as shown by the dotted lines, and the ends passed through a hole in the brace *B*, through a washer *C*, and secured



Joint for a screen door.

in a common nut by pouring the hole full of solder. Turning the nut twisted the wire and drew the joint tight. The pin, or dowel, *D* served to keep the parts from sliding out of place while the wire was being tightened.

Figs. 2 and 3 are self-explanatory, being merely adaptations of the miter and dovetail combined. Fig. 4 is a joint on essentially the same principle but was made by tacking adjoining pieces together, one on top of the other, but otherwise relatively in their final positions, and sawing through both with a band saw; the table of the machine being tilted to an amount equaling the thickness of the saw kerf in twice the thickness of the stock. Fig. 5 is a doweled miter, the holes for the long dowel *A* being bored before the parts were put together, and the others afterward. All these joints, except that shown in Fig. 1, were in flat frames for pictures, and, the contiguous parts being of wood of different shades, the effect was striking.



Joints for picture frames.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Principal Examiner John I. Brown

PRINCIPAL Examiner John Ingalls Brown is the "spring-wheel" man of the Patent Office; the division 41 is in his charge, including spring wheels in the class of resilient tires and wheels which, with railway draft appliances, make up the division 41, in Mr. Brown's charge since it was organized some years ago. While Mr. Brown is essentially a Maine man, he was born in Philadelphia, returning with his parents from that city to their former home in Maine when a child and continuing to reside in Bangor, where he attended the public schools.

Principal Examiner John I. Brown.

After teaching school and studying law, in 1884 he was appointed an assistant examiner in the Patent Office. He has served in two examining divisions and for some years in the classification division prior to his appointment as principal examiner and the institution of division 41 of which he has had charge for some years.

Raised as he was on the Maine coast, Mr. Brown has never lost his love of sailing. Sailing, however, is not Mr. Brown's only hobby, for he is very much of a "joiner," being a member of the Sons of the American Revolution, of the Knights of Pythias and of the Odd Fellows. To the latter he has devoted much attention, is a member of every branch of Odd Fellowship and one of the most distinguished members of that order, being known wherever the order has found its way throughout the United States. He is a grand representative to the Sovereign Grand Lodge I. O. O. F., District of Columbia, and was the Grand Master in 1898.

Mr. Brown is a member of the bar of the Supreme Court of the District of Columbia, and is now and has been for many years, president of the Beneficial Association of the Interior Department, which Association comprehends the various bureaus of the said department.

The class of resilient tires and wheels is a very active one at the present time because of the great interest in spring wheels and the like as substitutes for cushion tires in automobiles, while resilient tires including cushion tires and pneumatic tires will likely be active as long as automobiles and similar vehicles are used.

A Mechanical Willow Stripper

THE mechanical basket willow stripper with an automatic adjustment to compensate for the variation in thickness of rods has at last been made. The basket willow industry is practically the last of the agricultural crops in which labor-saving machines have been introduced. For over a hundred years willow growers have been looking for a machine that would successfully remove the bark of commercial willow rods used for making baskets and other articles. Five years ago Mr. George S. Herrick, a machinist of Syracuse, New York, undertook the task of designing a machine that would do the work. Mr. Herrick had already invented several other labor-saving devices, and after learning what an enormous amount of work was required to take rod after rod and remove the bark by hand, which is at best a very tiring and monotonous task, it occurred to him to make a mechanical willow stripper. It was a year before he had a machine to try out, and in 1907 he made his first experiment with one which he patented and which proved very encouraging to him and the willow growers around Syracuse. At the end of every season Mr. Herrick had another machine to try out and each time with a little more practical experience he finally succeeded in making one that does the work. On May 31st of last year he patented his mechanical stripper, which is in every way a labor-saving device, and will not only save farmers tens of thousands of dollars every year, but will greatly stimulate the industry both in this country and abroad. The primary object of this mechanical willow stripper is to supersede hand labor, and with the advent of this machine comes an increased and multiplied opportunity for making basket willow growing very profitable, which under our extensive methods of management, is almost impossible without a machine that will remove the bark at a comparatively small cost. The average laborer by the old method of peeling can remove the bark from 75 to 125 pounds of willow rods in a day if the rods are all of an average size. Assuming a laborer's wages to be $1.50 per day, the cost of peeling will be about 1½ cents per pound. The willow stripper, on the other hand, will peel as much in an hour as one man can peel in a day.

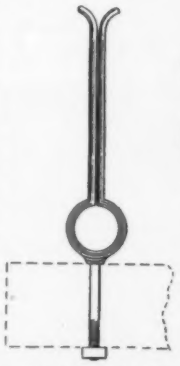


Fig. 1.—The old type of hand-brake.

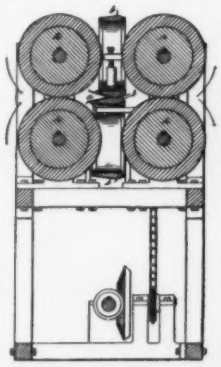


Fig. 5.—Cross-section of the new willow stripper along line x-x of Fig. 4.

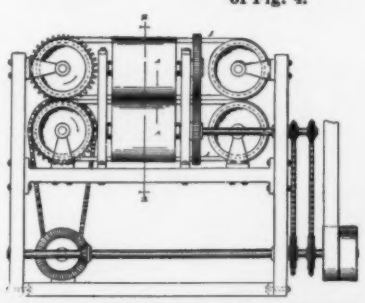


Fig. 4.—Longitudinal section of the new willow stripper.

When willows are peeled after the sap is up in the spring there are only from thirty to forty days in which to do the work. In order to peel all the rods from ten acres the grower is obliged to hire a small army of men, women, and children. The required labor is often very difficult to find. The mechanical stripper will do the work of ten men and will save the farmer's money and temper, for it will strip his willows more cheaply than if done by hand. It is estimated that hand peeling costs about $35 per acre. The machine can do this work in just one-tenth of the time and will cost between $3 and $4 per acre. It is safe to estimate that the farmer will save approximately $30 on each acre. Mr. Herrick stripped steamed willow rods right along through January, February, and March, and averaged 125 pounds of rods an hour, which is all that one man can handle in operating the machine. Mr. Herrick is now designing an automatic feeder, by means of which the daily output will be greatly increased. Of course the amount that can be stripped in a day will vary greatly under different conditions and with rods of different sizes and varieties. The superiority of this machine over the ordinary brake can hardly be overestimated. The brake (Fig. 1) is a simple device consisting of a round steel rod from ½ to ⅝ of an inch in diameter and about 4 feet long, which is doubled over so that the two ends are brought together, making a double rod 2 feet long. The lower or welded end of the parallel rods must be inserted in a log placed at a convenient height. The brake must be perpendicular and have the upper ends of the prongs slightly curved out one inch from the top so that the rods can easily be put in the brake. The operator places the thick end of the rod between the prongs of the brake and draws it toward him and the bark is at once separated from the wood. The small end is then treated in a similar way, which completes the peeling. Figure 2 shows the method of operating the brake.

Fig. 2.—The old method—stripping with the hand-brake.

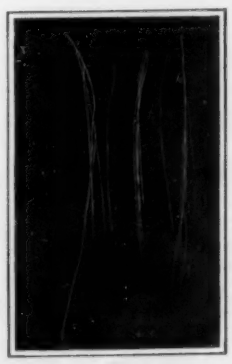


Fig. 6.—Rods stripped by the machine.

The mechanical willow stripper is illustrated in Fig. 3. The operator inserts the butt ends of from 2 to 4 rods at a time between two rapidly revolving rubber-faced rollers which are slightly furrowed and which form a suitable feeding device. These rollers, which are in pinching contact, are disposed to receive the willow rods transversely and to crack and split the bark throughout their entire length.

Fig. 3.—The mechanical willow stripper.

After the butt ends of the rods have passed through the first pair of rollers (Fig. 5, *r*) they pass between two parallel horizontal rubber belts (Fig. 5, *bb* at *a*) disposed to receive the willow rods transversely between them. These belts, which are known as stripping-members, move in a direction at right angles to the rods passing between the first pair of rollers and are designed to strip the bark from the rods. These belts are driven at a comparatively slow speed, while the receiving or feeding rollers are operated at a relatively high speed. The faces of these two horizontal belts are in close contact and have their contacting faces correspondingly beveled so that the rods may readily pass between them (Fig. 5, *a*). The rods are pushed between these two horizontal belts by the feeding rollers and are then received on the opposite side by the second set of rubber-faced rollers of similar size and are operated at a speed equal to that of the first set of rollers. The second pair of rollers are designed for drawing the stripped rods from the belts, as is seen in Fig. 3.

Every part of the machinery is carefully adjusted, but like all other machinery the willow stripper is not perfect. It will doubtless be continually improved. Having undergone, however, nearly five years of trial and improvement before it was offered to the public, it is much further advanced than a good many other labor-saving machines when they are first placed on the market. The machine itself, though simple in the extreme, is about as inspiring to the willow grower as the reaper was to the wheat grower. It removes the bark from small and large rods by the same turn of the wheels and does not seem to discriminate between the branched and unbranched ones (Fig. 6).

The full extent of what the willow peeler will achieve for the grower still

remain to be seen, but it will at least make him independent of an army of shiftless and itinerant laborers required every spring for peeling willows. It will make willow growing a scientific industry like that of the other minor farm crops. It means a new era in the basket willow industry.

How I Invented the Air Brake—IV*

By George Westinghouse

BEING fully impressed with the idea that if the wave of air which was utilized for signaling could be made to operate the triple valves upon the cars, there would then be an almost instantaneous application of the brakes upon the front, rear and other portions of the train, this idea, with hard work and a large number of experiments, shortly produced what is now known as the quick-action automatic brake. The Westinghouse train was left at Burlington in order that the new triple valves with the quick action attachment could be applied and further experiments made. The valves as developed for this emergency proved to be successful, and the tests made with this train after their application were eminently satisfactory to the railway officials. It was thereupon arranged to take this train to Minneapolis and St. Paul, Milwaukee, Chicago, St. Louis, Cincinnati, New York, Albany, through to Boston and New England, to Washington, and then to Pittsburg, numerous demonstrations being made during this journey of some thousands of miles. This train, drawn by two locomotives, was frequently run at speeds above 50 miles an hour, and the tests were witnessed by all of the prominent railroad people of the country. So great was the demand for good brakes on freight trains that considerable difficulty was at first experienced in promptly filling the orders of railway companies. Nevertheless, the wide publicity given to these tests, coupled with a public demand for the adoption of means to prevent accidents, brought about the enactment of a law by the Congress obliging the railways to apply brakes and also automatic couplers to all freight trains in the United States within a time named in the act, which time was subsequently extended because it was physically impossible for the railway companies to make the introduction within the time first prescribed. The quick action automatic brake was operated like the first automatic brake for ordinary train movements; the quick action resulted only when it was necessary to apply the brakes for an emergency.

No sooner had the quick action automatic brake been developed to operate successfully on trains of fifty cars than new conditions were presented. Steel freight cars carrying enormous loads had in the meantime been developed and freight locomotives had been increased in capacity, so that trains were often composed of seventy to eighty cars, and more recently some trains have had as high as one hundred cars. This possibility had, however, been foreseen, and experiments were constantly being carried on to so improve the apparatus that it could be used to control trains of any practical length, and these experiments also had in view the more nearly instantaneous action of the brakes for ordinary service purposes than was possible with the automatic brake or with the quick action brake. The result was a most important development.

The present improved triple valve has the emergency feature, but it also has what is known as the quick-service application feature, that is, for ordinary purposes, the air is admitted to all of the brake cylinders so quickly that the longest freight train can be handled with almost the precision obtainable in the control of passenger trains of from six to twelve cars.

In the matter of the development of the brakes for operation upon passenger trains, nothing that skill and perseverance could suggest has been omitted in securing the highest degree of perfection. The requirements during the past few years, by reason of the greater weight of cars and locomotives and of the higher speeds at which they are run, have necessitated the redesigning of all the passenger train brake apparatus, including the method of attaching the brake shoes to the cars and the levers and connections for bringing these shoes to bear with the required pressure upon the wheels. For the purpose of insuring the highest efficiency, every wheel of a passenger train, including those under the locomotive, is now acted upon, whereas formerly many of the master mechanics and engineers were apprehensive that it would not be possible to make use of all of the wheels of a locomotive for braking purposes.

During the past twelve months, most elaborate tests of the latest form of apparatus for passenger service have been carried out under the direction of officials of several railways and of the Westinghouse Air Brake Company, in order to prove the operativeness of the new constructions and their capability to insure the highest degree of efficiency.

From the very beginning of its operations, the brake company has maintained a strong staff of experienced engineers, some of whom are located in each of the large railway centers and whose services are always at the command of the railways. It is the duty of one or more of these trained men to proceed to the scene of any accident that may have occurred in order to ascertain the cause, to report thereon, and to render such aid and co-operation to the railway officials as will tend to avoid a like accident if in any manner the brake can contribute to that end.

The air brake company has always had in its works, for experimental purposes, sets of brake cylinders, pipes and couplings, representing the apparatus upon trains of various lengths, so that tests and demonstrations could be readily made for all sorts of purposes, including educating or informing railway officials who came to seek information. To more effectively spread this information, the company, about fifteen years ago, constructed and equipped a special instruction car in which were arranged fifty sets of brake cylinders and pipes equivalent to like apparatus upon a freight train. This car was provided with a boiler to drive the air-pump for the production of the air under pressure needed to operate the brakes. Operative models of all parts of the apparatus were shown in section, so that their construction and operation could be more quickly comprehended. This car, in charge of experienced instructors, was moved from place to place, and engineers, firemen, conductors and other train employees in general visited it to familiarize themselves not only with the operation of the brake, but with its construction, and in this manner there has been developed throughout the country a knowledge of the air brake art which has proved of inestimable value to the railway corporations and their patrons. The records of the Westinghouse Air Brake Company show that to December 1st, 1910, their instruction car traveled over 113,000 miles. Numerous railways have also provided their own instruction cars, so that it may be safely said that every railway employee having anything to do with the operation of trains, freight or passenger, has been required to familiarize himself with the working of the brakes and to so study the subject that he could pass an examination; 280,258 employees having so far been examined by representatives of the Westinghouse Air Brake Company, and in numerous cases these men have been required to show sufficient knowledge of the brake to entitle them to receive certificates of their proficiency.

The importance of the maintenance of the brake to railways has not been overlooked by railway officials. They have appointed superintendents of brakes and numerous inspectors, and to-day there is an association of air brake officials organized in 1893, and now having 1,015 members, who meet annually in convention to thoroughly discuss the questions which are constantly arising, so that at present there exists an organization of which scarcely any of the public has ever heard —an organization which is constantly devoting skill and energy to the care of apparatus which above everything else in connection with railways contributes to the safe transportation of passengers and freight.

I have often been asked how many lives have been saved by the use of the air brake, and I have as often said it might well be a great many thousand, but that it was impossible to make even an approximate estimate. At a banquet given in Washington to the members of the International Railway Congress, in May, 1905, a diplomat, in speaking on the subject of the importance of railway brakes, said he felt safe in saying the air brake had saved more lives than any general had ever lost in a great battle.

I have spoken of four chief developments. It has been necessary, in order to avoid disastrous consequences, that each development should be of such a kind that cars fitted with newer apparatus could operate with little inconvenience with cars fitted with earlier apparatus. As it stands to-day, scarcely any of the old type of brake and the first type of automatic air brake are in use, but should a car fitted with the first form of automatic brake be found and put into a train with the more modern apparatus, such older apparatus would be found to operate fairly well with the more perfect form. The prevailing idea in the development and introduction of the brake has therefore been an adherence to such uniformity of apparatus that the interchange of traffic over various roads could go on uninterruptedly.

There is probably no apparatus now in use which has received such thoughtful consideration and been the object of such care in every one of its details as what is now popularly known as the air brake, and which is in universal use in the United States and in many other countries of the world.

In my estimation, there could be no better illustration of the value of the maintenance of standards than has been given by the manufacture and introduction of air brakes upon railways, for without such standards, train brakes would not have come into general use, with consequences which railway officials and the public can well appreciate.

My story would be incomplete without a reference to the powerful assistance which the railways of this and many other countries have rendered. They have been lavish in providing those facilities for making the thousands of tests which were necessary to progress in the developments I have recited; to the Pennsylvania Railroad especially, upon which the most important experiments were first made, the other railways of the country, as well as the traveling public, owe a debt of gratitude. When a railway (as did the Southern Pacific two years ago) provides a new train of one hundred steel cars to be fitted with the newer form of automatic brake, in order to carry on, with a staff of skilled men under the direction of the chief officers of the company, a series of experiments upon its heaviest gradients, requiring several weeks, for the purpose of securing greater safety and an increased carrying capacity per train, with the consequent lessening of the cost of transportation, it is just that the managers of such a corporation should receive credit for their far-sighted policy. To name the railways and to merely state chronologically the tests of brakes which have been made during forty years would require several volumes.

* From Presidential Address presented at the Annual meeting of the American Society of Mechanical Engineers.

Notes for Inventors

A Narcotic Cartridge.—Karl Burgsmüller of Kreiensen, Germany, has been granted a patent, No. 993,023, for a means for temporarily narcotizing animals, in which a cartridge filled with a mixture composed of substances containing capsicine in an immediately gasifiable form and of easily inflammable substances to accelerate the gasification, is combined with a small quantity of an explosive agent between the mixture and an explosive cap with which the cartridge is provided.

A Curious Anticipation.—An old practitioner before the Patent Office tells of filing an application for patent for a Texas inventor for an improvement in the cutlery class. The invention was unique and examination of the previous patents in the same class failed to develop anything to limit the novelty of the invention in any degree. Much to the attorney's surprise, in acting on the application for patent, the Patent Office Examiner cited, in anticipation of the device, the identical article which the assistant examiner having charge of the application had purchased in Nova Scotia while on vacation many years before, had brought to the United States and had been using on his desk in the Patent Office for more than the statutory period.

Beauty and Invention.—With a woman's appreciation of the importance of anything that aids beauty, Anna Taylor, of Ottawa, Ontario, Canada, has patented, No. 994,619, an artificial eye lash. It is made with a crescent shaped strip of material supplied with adhesive so it can be held in place and short lengths of hair held on the underside of the strip and projecting outwardly from its convex side.

Handling Ships' Cargoes.—The more convenient handling of ship cargoes, is the purpose of the invention of Onofre Lindsay of Valparaiso, Chile, and his patent, No. 994,171, includes a cable way which is fixed at one end and is movably supported at its other end to which is releasably connected a counterpoise. The haul rope, which is endless, engages the counterpoise and also extends around the fixed end of the cable way.

A Swimming Device.—Just in time for the bathing season is a patent to John A. Edwards of Birmingham, Ala. His invention is a swimming device and provides a number of floats to rest on the surface of the water. These floats support an elevated frame work, and hangers drop down from the frame and are connected to the swimmers in the water.

A Pot That Serves Tea or Coffee.—It may be desired to serve several beverages such as tea, coffee and cocoa and Jos. N. Papendry of East Liverpool, Ohio, has patented No. 994,949, a combination pot, which has a number of independent compartments to receive the different beverages. A single spout has openings communicating with their respective compartments and valves control these openings are worked from a point near the handle so the person pouring can open any particular valve and so cause tea, coffee or cocoa to discharge from the spout.

Automobile Accidents and Their Prevention.—Many automobile accidents appear to occur most frequently from breaking or derangement of the steering gear or the bursting or throwing of a tire. It was suggested that in many plants, and machines, duplicate parts were provided which could be quickly brought into use in lieu of broken or otherwise disabled ones, and that possibly this could be done in the case of an automobile parts referred to above.

with the duplicate parts so arranged as to be brought into play, automatically or by the driver, when the original part was disabled. My friend said he thought it would be a good thing, but he did not see how it could be done. Neither did I, or I would do it and reap the reward of a very valuable invention.

An Ingenious Sign.—Much ingenuity and sometimes considerable invention is involved in the production of signs and display cards used by merchants in their show windows. We recently noticed in the window of a paint store a sign made up of a plate of sheet metal on which water was represented. Four slits were made, one near each corner of the plate, and through the upper slits projected the feet and legs of a large doll, while the arms projected outwardly from the rear through the lower slits and appeared to be reaching out for small cans of paint. These cans of paint were placed on sand which had been strewn upon the floor of the window to represent a beach, the whole presenting quite a realistic appearance. On the sheet were written the words "Come in," the effect being that of a diver whose arms and legs projected above the surface of the water, but whose body was submerged. The sign attracted much attention, and an amusing feature was to notice children, who almost invariably would look behind the sheet to see the rest of the figure. The idea of this sign is obviously capable of many modifications.

German and American Saws.—German carpenters use, instead of hand-saws of the form familiar to every American, those of the bucksaw type, only with a narrow blade, which as a rule must be slightly turned out of the plane of the frame, in order to take in boards of a greater width than would be possible otherwise, owing to the middle bar. The result of this position of the blade is a tendency on the part of the frame to turn downward out of the slightly inclined plane in which it lies, so that there is always a strain on the workman's wrist, and often the work is not straight. There is in this style of saw the further disadvantage, that in sawing diagonally across the middle of a piece of work consisting of two boards at right angles to one another, no inclination of blade to frame will enable the piece to be worked. I have often asserted this, and recently in my own house was compelled to lend a carpenter who was shortening a bench my American saw—of what the Germans call the "fox tail" pattern. I think that if American saw makers would combine and send a man over there to manipulate the American pattern on work where it can be used and the German bucksaw type can not, there would be an opening for good trade.

Why Not a Brazing Machine?—He was a working man with whom the writer got into conversation at the sea shore. The man said he was a coppersmith, and that he had worked in all the navy yards from Maine to California. His talk about his work was full of interest, particularly about the assisting machines and apparatus employed in the various manipulations of copper. It was astonishing to learn that no machine had been produced for use in brazing copper, but that the operation was still carried out entirely by hand. No reason is seen why the inventive faculties could not be advantageously employed in solving this problem.

An Ozone Apparatus.—An ozone producing apparatus was patented May 23rd, 1911, to Octave Patin of Paris, France. It is made with two concentric glass tubes separated by an annular space, an inner electrode frictionally engaging within the central tube and outer electrode of wire forming a helix and wound in spiral form upon the outer tube and providing a metallic envelope for the outer tube.

Legal Notes

The Flare-back in Court.—An important patent case, that of John J. Knapp, Trustee, vs. the United States, awaits decision in the Court of Claims, having been argued before that court some weeks ago. The suit is under the general jurisdiction of the Court and not its special jurisdiction of patent matters. The invention forming the subject of the suit seeks to prevent flare-backs in heavy ordnance, and seems to be of much importance to the ordnance branches of the Government, and hundreds of pages of expert testimony, provided on both sides, and extensive illuminating briefs of counsel indicate the importance of the case, which is said in some quarters to involve claims for damages of upward of a million dollars.

Iterations in Patents.—The importance of avoiding any alteration in an application for a patent after it is signed and sworn to is emphasized in a decision of Assistant Commissioner Tennant in the case of Ames vs. Lindstrom, decided October 8th, 1910, in which the Assistant Commissioner, after referring to the alterations made in the application subsequent to its execution and prior to its filing in the Patent Office, says: "The application of Lindstrom is therefore not an application upon which a patent can be granted and cannot be given the effect of a constructive reduction to practice." He further says: "As Lindstrom cannot be given the benefit of the filing of his application as constructive reduction to practice, Ames is entitled to an award of priority."

Plaster Works and Their Use.—In holding an optical prism device "of scientific or technical character," pressed to shape in plastic glass, for modifying light rays, not of the class intended to be covered by section 5, sub-paragraph 1, of the Copyright Act of March 4th, 1909, Justice Stafford of the Supreme Court of the District of Columbia, in Brock vs. National Electrical Supply Company, said: "The objects are formed of glass when in a plastic condition by the use of a mold, and so, perhaps, may be considered in a liberal sense 'plastic works,' although, of course, fragile and brittle in their completed state. It is insisted that they are 'of a scientific or technical character,' because they are scientifically or technically produced. It is not claimed that they are intended for, or adapted to, special use, in any science or in any branch of technic. . . . It seems clear to the court that it was the use to be made of the drawings and the plastic works rather than the knowledge or skill required for their production that was referred to in the words, 'scientific or technical.' Hence it is believed that the objects exhibited are not of the class intended to be covered by the clause in question, and consequently that the plaintiff's bill is insufficient."

Pure Food and Trademarks.—The Patent Office will not pass favorably on an application for registration of a trademark for a meat product until at least one of the labels filed is stamped by the Bureau of Animal Industries of the Agricultural Department, "Approved, B. A. I." The purpose of this is to prevent the registration of any mark for meat products until the products have been approved.

Recent Adjudicated Patents.—Out of seven adjudicated patents reported in the *Patent Office Gazette* of June 6th, 1911, only two were held void in whole or in part. In one of these cases, Anton vs. Grier Bros. Co. (C. C. A.) 185 Fed. Rep., 796, one claim of the patent was held void as an aggregation of old elements. In the other case, that of Hestonville M. & F. Pass. Ry. Co. vs. McDuffee (C. C. A.), 185 Fed. Rep., 798, the patent was held to be void as having been granted on an amended application and claim which was a distinct departure from the original.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

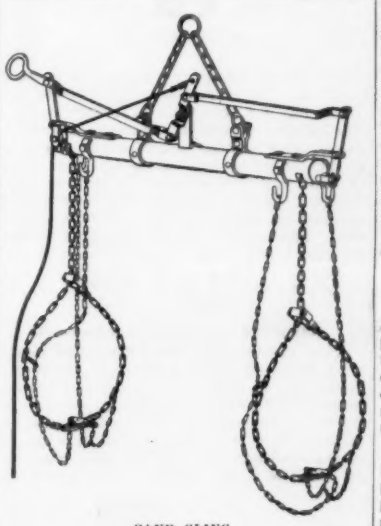
Of Interest to Farmers.

GRAIN WEIGHING SCALE.—A. MCLEOD and A. T. MCLEOD, Bloomington, Ill. Material is received into a stationary hopper and discharges therefrom into a vertically movable weighing-hopper, so suspended and connected with pivoted weighted beams and other mechanism, that, when a certain load has been received, the weighing-hopper descends a little, whereby a valve controlling discharge from the receiving hopper into the weighing-hopper is closed, and then the gate at the bottom of the weighing-hopper is opened to allow the discharge of the grain or other material therefrom.

Of General Interest.

ANIMAL TRAP.—W. G. GATES, Wallace, Idaho. This trap is adapted for use in capturing rodents such as mice, rats, mink, and muskrats, but is also available for capturing larger animals when made of sufficient size. The invention relates particularly to an improvement in box or cage traps and to means for tripping and releasing spring-actuated doors, so that they close automatically and confine the animal.

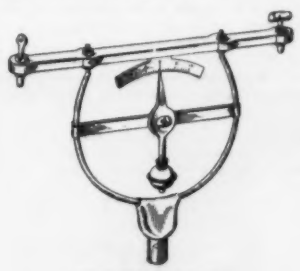
CANE SLING.—PHILLIP E SEVIN and SIDNEY P. ROUSSEL, Mathews, La. The object of the invention is to provide a simple and easily operated cane sling which will firmly hold the load during the hoisting and conveying, and which may be easily operated to release the load when ready to dump. In operation a chain is passed beneath the load,



CANE SLING.

through the stirrups of a chain which passes above the load and into engagement with the pin. When the cord is pulled and the chain ends released the lower chain pulls through the stirrup, releasing the load. The embodiment shown in the illustration herewith is especially adapted for heavy loads, since the chains separate beneath the load. The coupling consists essentially of a socket, a pin, and a locking pin for preventing detachment of the socket and pin.

SURVEYOR'S LEVEL.—WILLIAM M. JACOBS, Vale, Ore. The level pictured in the engraving presents a side elevation of the complete instrument, which is for use specifically as a simple surveying instrument for determining inclinations, grades, levels, etc. It



SURVEYOR'S LEVEL.

may be subjected to rough or severe usage without material damage to its construction. It may be easily adjusted should its calibration be disturbed. The invention provides adjustments and mechanisms for varying the sensitiveness of the grade indicating mechanism.

MEANS FOR RAISING SUNKEN VESSELS.—JAMES SKATSCHKOFF, 1 Degtiarnoipereoulok, St. Petersburg, Russia. In carrying out this invention, a case or casing is made of waterproof tarpaulin which is open at the bottom, the case resembling the form of the vessel which is to be raised. The case thus consists of a top portion and side walls, which latter extend down far enough to inclose the upper portion of the hull of the vessel.

CAGE TRAP.—I. RAMIREZ, Matamoras, Mexico. This invention relates to cage traps, and while the trap is designed more particularly for rats and mice, the features of construction may be utilized in traps intended more specially for catching other animals alive. The chief object is to produce a trap that will be efficient in operation and entirely safe for human manipulation, even by children.

CARGO HANDLING APPARATUS. — O. LINDSAY, Valparaiso, Chile, S. A. This device transfers cargoes at sea from one vessel to another by means of a cableway, stretched from the first to the second and upon which suitable carriages having conveying receptacles thereon are arranged to travel, the cableway being connected with means for keeping the same taut, to permit the carriages being easily hauled thereover by hauling means engaging the carriages and extending from one vessel to the other.

SUBMARINE BOAT.—G. B. YERTON, New York, N. Y. Embodied in this invention is a life-boat for attachment to a submarine craft, for rescuing the crew of the craft should the same sink or become dangerously disabled when beneath the surface of the water. The life-boat is for removable attachment to a submarine craft, the boat being secured in such a manner that the same can be released by the crew or one of the crew, in a very short space of time.

SAVINGS BANK.—C. A. WALES, Stratford, Conn. The invention provides improvements in banks or boxes, whereby the closure cap is conveniently placed in position on the box body and held therein against removal by unauthorized persons, without the use of special locking devices, and whereby the cap can be readily removed by the use of a special implement in the hands of a proper person, to allow of emptying the bank of its coin or other contents.

BLIND IRON.—F. S. BARDEN, Salida, Colo. The invention is an improvement in blind irons or stiffeners such as are ordinarily used in the blinds of harness, and has for its object a stiffener which prevents the breaking of the stitches or leather of the blind by rubbing, or other causes, at point of attachment of the winker brace, and the brace from being torn out.

Hardware and Tools.

PLIERS.—P. G. STORMER, Johnstown, Pa. An object of this invention is to provide a pair of pliers which will enable the operator to bend wire or like members into either a curved or straight form, and further permit of the operator securing a firm but quickly releasable hold on fragile, delicate or diminutive articles.

SAFETY WINDOW LOCK.—E. V. AMATO, New York, N. Y. The invention provides a plate located upon one sash and carrying pawls, each forming a practically closed loop; provides a locking member having the form of a casing and adapted to be located upon the other sash, and also having means for engaging any one of the pawls; and provides means for holding the pawls in positive engagement with the casing.

COMBINED PROTRACTOR AND T SQUARE.—F. A. DEL CASTILLO, Washington, D. C. The object here is to provide a combined protractor and T square, for the use of draftsmen, engineers and others and arranged to permit of setting the blades of the square to any desired angle indicated on the protractor or to accurately fasten the blade in right-angle position relative to the base of the protractor.

Heating and Lighting.

HEATING APPARATUS.—M. MÉRAN and M. M. MÉRAN, 155 Rue du Faubourg Poissonniére, Paris, France. This air and gas mixer provides before combustion, a mixture as perfect and intimate as possible, the quantities being supposed suitable, so as to obtain a flame furnishing maximum heat, which latter is increased or reduced by variation of the gas burner. Means provide raising to the highest possible temperature a refractory body which will subsequently radiate its heat without detriment to gas combustion. The refractory body is of such shape that it can undergo sudden expansion without cracking or splitting.

Household Utilities.

ELECTRIC IRONING DEVICE.—G. A. RICKS, La Fayette, Ind. This device is adapted to overcome the difficulties common with movable tools; and the object of the inventor is to provide a suitable support for a flexible conductor, and a means for protecting the conductor to keep it off the working surface and away from the tool, and to prevent any interference with the working of the tool.

AUTOMATIC WEATHER STRIP.—G. L. GODFREY, Steuben, Maine. This strip is for use on closures such as doors and the like, to prevent moisture or inclement weather from getting into a room through the space ordinarily found between a closure and the casing thereof. For this, use is made of a casing provided with means engaging a second casing in cor-

nection with a packing, and spring-controlled means for automatically raising or lowering the packing when the door is opened or closed.

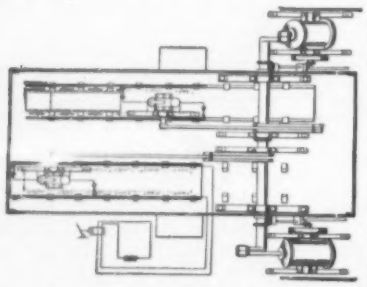
Machines and Mechanical Devices.

METAL STAMPING PRESS.—E. H. VOGEL, New York, N. Y. Mr. Vogel's invention refers to presses of the kind used for stamping and performing analogous operations, such as punching, shearing, bending and the like, his more particular purpose being to provide a mechanism for increasing the efficiency of the machine, while promoting simplicity of operation and cheapness of operation.

SKEWER MAKING MACHINE.—R. A. GROVES, Andover, Maine. Generally speaking, this improvement comprises a feed wheel provided with pockets for picking up skewers one at a time from a hopper, and a dressing wheel parallel with the feed wheel, but slightly eccentric in relation thereto, the purpose of the wheel being to grind off adjacent ends of the skewer blanks while the latter are carried partially around by the feed wheel.

COIN CONTROLLED APPARATUS FOR VENDING MACHINES.—O. J. HOTALING, Johnstown, N. Y. The device is one which can be used with other vending machines, which serves to prevent the operation of the machine with which it is employed unless the suitable predetermined coins are introduced into the coin slot, which can be adjusted to operate with one or more coins of different kinds, which requires little power to actuate it, which does not modify or affect the operation of the machine, and which is so made that unauthorized or improper operation thereof is accomplished only with difficulty.

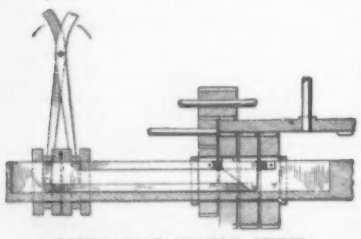
MEANS FOR THE PROPULSION OF VESSELS.—WILLIAM H. WITTE, Homewood, Charles St. Ave., Baltimore, Md. The invention illustrated by the engraving relates to means for propelling marine vessels. One object is to provide an improved form of slidable plate for carrying the driving pistons. Another, is to do away with friction caused by the use of inclosing pipes or chutes for the pistons. There are several advantages here



MEANS FOR PROPULSION OF VESSELS.

over that form of the device shown in Mr. Witte's prior patent. There is no surrounding tube or pipe below the bottom of the vessel in which the pistons move. The sliding plate is raised from near the bottom of the vessel. The compressed air chamber is disposed so as to cover both slides and a portion of the operating mechanism therefor. Air pressure is maintained in the chamber by air pumps. Friction is reduced, and the slide plates do not fit airtight.

POWER TRANSMISSION DEVICE.—ANDREW F. STURM, Nehawka, Neb. In this illustrated invention the object is to provide a device in which a direct forward or a reverse movement may be attained by the use of a clutch member carried by the main shaft. It provides a device in which forward



POWER TRANSMISSION DEVICE.

and reverse movement may be attained by simple mechanism, thereby eliminating the annoyances occasioned by a multiplicity of parts and reducing cost of manufacture to a minimum. It may be used on automobiles or other devices in which forward and reverse movements are used, and means are provided whereby variable speed movements may be attained.

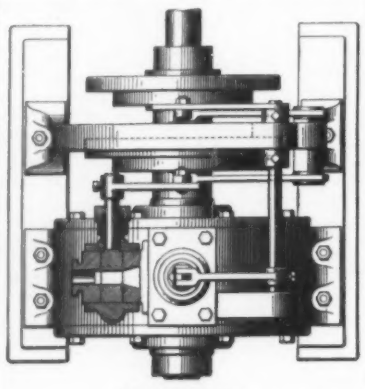
BRICK MACHINE.—A. S. BACON, Oklahoma, Okla. The object of the invention is to provide an improved brick machine, especially adapted for use in the making of cement brick, which will receive the plastic material and press it into shape, and having means for expeditiously removing the pressed brick onto a pallet for removal from the machine.

COMBINED PUMP AND AERATOR.—R. W. KELLY, deceased; SARAH KELLY, administratrix, Atchison, Kan. In the present patent the object of the inventor is the provision of a new and improved combined water pump and aerator, for use on cisterns, wells and various other water supplies and arranged to aerate the water wherever the pump is actuated for lifting or raising water.

PRINTING MACHINE. — W. JACKSON, New York, N. Y. The invention has reference to wall paper printing machines, and its purpose is the provision of certain new and useful improvements in printing machines for printing wall paper borders, whereby the paper after it receives the imprint by the printing rolls is accurately cut lengthwise along the contour of the imprint.

Prime Movers and Their Accessories.

ROTARY ENGINE.—WILLIAM P. MCMANNAMY and JOHN P. JOHNSON, care of Thompson and Stout, Whipps Block, Kalispell, Mont. A plan view with parts in section is given herewith in the illustration of this invention

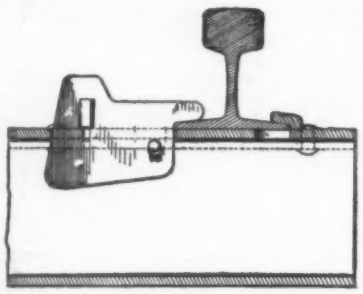


ROTARY ENGINE.

which relates to rotary engines, particularly for steam or other gaseous driving agents, and which has for its object to provide an engine capable of working efficiently in any position, with especial provision of means to prevent or reduce the leakage of steam. Two or more cylinders and pistons may be used, combined so that their working periods will alternate or overlap, so as to avoid dead centers. The construction of the piston of two separate parts, allows for expansion and contraction. The packing rings may be held against the piston by steam.

Railways and Their Accessories.

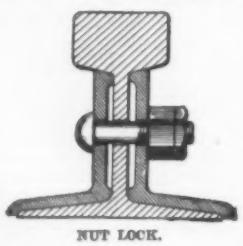
RAIL FASTENING FOR METALLIC RAILWAY TIES.—ALEXANDER BRYFOGLE, Main St., West Easton, Pa. Mr. Bryfogle's invention illustrated herewith is an improvement in rail fastenings on which a rail-clamping plate is arranged in a slot in the top of a metal tie arranged adjacent to the rail base supported on the tee. The fastening is preferably



RAIL FASTENING FOR METALLIC RAILWAY TIES.

formed as a cotter-pin whose upper edge is inclined to form the wedge proper. It may be readily detached by withdrawing a wedge when the plate will drop down into the tie, thus leaving the rail proper free of obstruction on the inner side, so that it may be readily detached from the lugs and removed from the tie.

NUT LOCK.—THOMAS F. MAY, Lehi, Utah. Mr. May's invention is an improvement in nuts locked by means of a smaller jam nut. The

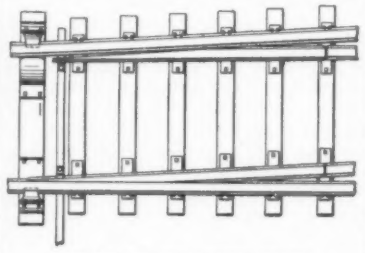


NUT LOCK.

engraving represents a vertical cross section of a railroad rail provided with fish plates secured by a bolt provided with his nut-lock. Both nuts being of the same size and form, one wrench of fixed adjustment serves to screw them both home, or to remove both from the nut. Not only does one wrench serve to put on and take off the nut, but it holds the bores of the main and lock nut in alinement, while both are being put on and removed from the bolt, thus preventing the locked nut from turning so as to bring its axial bore out of alinement with that of the bolt nut. The same adjusted wrench sets the lock nut.

CAR JOURNAL OILER.—E. P. BERGMAN, Cherokee, Okla. The device is for use in oiling journals of cars and other similar vehicles, and for preventing "hot boxes." The device oils automatically, when the heat generated by the rotation of the axle rises to a certain point. It works upon the principle of the expansion of liquids or gases to effect the operation of valves for permitting the feeding of oil to the box.

RAIL PLATE AND WHEEL GUARD.—GEORGE H. LANGTON, Master Mechanic K. C., So. Ry., Shreveport, La. The invention relates to rails for railways and the aim is to provide a guard, for switch points, to guide the wheels of a train safely over the switch point and prevent a derailment. For this purpose use is made of a base plate for attach-

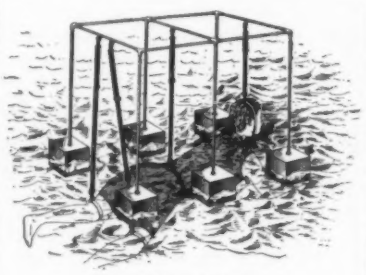


RAIL PLATE AND WHEEL GUARD.

ment to a railway tie and adapted to receive a rail thereon, a rail plate on the base plate and extending upwardly and inwardly to engage the rail and wheel guard formed on the base plate and extending toward the rail plate, the guard wheel being spaced from the said rail. The plan view shows herewith a switch with the device applied thereto at the switch point end of the switch.

Pertaining to Recreation.

SWIMMING DEVICE.—JOHN A. EDWARDS, 3701 Avenue F, Birmingham, Ala. The device pictured herewith shows the manner in which a swimmer is supported. It comprises a plurality of floats, a frame-work arranged



SWIMMING DEVICE.

upon the floats and supported by them, and adjustable means attached to the frame-work for supporting a swimmer in the water. It is inexpensive to manufacture and in supporting a person it is so constructed as to allow the free use of the swimmer's limbs at all times.

Pertaining to Vehicles.

RESILIENT WHEEL.—W. F. MASTERS, New York, N. Y. The invention has in view a wheel having a tire with roller bearings arranged between the wheel body and the tire, which tend to expand the tire and to keep the latter under tension by a flattening strain, or a tendency of the tire and body of the wheel to rotate relatively. Other wheels, such as pulleys, can be constructed in accordance with the invention.

WIND SHIELD.—J. H. SPRAGUE, Norwalk, Ohio. In this shield the movement of the upper section is controlled and limited by two distinct separate and connecting means. One of these permits the two sections to move as though hinged together or permits them to be held with their adjacent edges spaced apart and in different planes. The other serves to lock the two sections in their adjusted position.

Designs.

DESIGN FOR A PAPER CUTTER.—E. F. CALDWELL, New York, N. Y. This ornamental design for a paper cutter shows an implement of substantial and graceful form, the blade and handle end having the same width through the entire length. The scroll work and other ornamentation represent design of excellent artistic quality.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE BLUE GOOSE CHASE. A Camera-Hunting Adventure in Louisiana. By Herbert K. Job, State Ornithologist of Connecticut. New York: The Baker & Taylor Company, 1911. 8vo.; 331 pp.; illustrated. Price, $1.25 net, postage 12 cents.

It is not a bad idea to get boys interested in the newer kind of hunting—that is, a hunting with the camera rather than with the gun. Taking as his theme the rediscovery of the winter haunt of the blue goose, the author takes his boy heroes on queer jaunts, across the Louisiana marshes, and through water and fire, imparting by the way an accurate knowledge of Nature and her children of fur and feathers.

ELECTRICIANS' OPERATING AND TESTING MANUAL. By H. C. Horstmann and V. H. Tousley. Chicago: Frederick J. Drake & Co., 1910. 359 pp.; 16mo.

The first few chapters of this little book give an introductory review of the fundamental definitions and points of general theory. Then follows a description of the several types of dynamos and motors, hints for the operation of these machines, chapters on transformers, batteries, lamps, testing, locating dynamo and motor troubles, etc. The print is excellent. The book is bound in a soft leather cover, which adapts it for pocket use.

MOTOR BOATS SIMPLY EXPLAINED. By John Douglas. London: Percival Marshall & Co. 16mo.; 98 pp.; illustrated.

The first chapter is devoted to hull construction—the "carvel" system, the multiple-skin hull, the clinker build—with drawings and specifications for a simple launch, some brief discussion of the different styles of boats, and a description of the hydroplane. The second chapter describes the motor and has some very clear diagrams showing the various types and their operation. Fuel, ignition, and driving-gear furnish the subject for other chapters, and hints on the maintenance and running of a pleasure launch follow. As the book is an English publication, the Thames rules and regulations are given in an appendix.

PLUMBING AND HOUSEHOLD SANITATION. By J. Pickering Putnam. Garden City, New York: Doubleday, Page & Co., 1911. 8vo.; 718 pp.; illustrated. Price, $3.75 net.

"Plumbing and Household Sanitation" is on a higher plane than most works of a similar nature. Mr. Putnam's standing as a member of the leading architectural guilds perhaps accounts for this. From cover design to final illustration it is an attractive book to scan, and a close study of the text confirms our first impression of careful preparation and full treatment. The aim is the discovery of the best and simplest method of insuring a healthy home. Types of appliances and methods of construction are presented, and the reader is educated up to the point where he may safely use his own judgment as to particular makes, of which there are such a multiplicity that merely to catalogue them would exhaust the space at command. Many ideas and conclusions are advanced which the writer admits to be not quite orthodox. But he believes that it is now possible for one to demonstrate for himself at slight expense whether the contentions put forth in such cases are correct. He has done much in the past to introduce advanced methods and to cheapen the cost of appliances. "Simplification" is his slogan. Among other things he advocates the omission of the main house trap, and puts forward practical means for otherwise simplifying the systems generally in use.

PENROSE'S PICTORIAL ANNUAL. Edited by William Gamble. 1910-1911. Vol. 16. London: Percy Lund, Humphries & Co., Ltd. 8vo.; 192 pp.

There is a period in the development of the child when he becomes ashamed to be seen with a "picture book." Later he finds that the love of pictures is not a thing to conceal, but a thing to enjoy openly with the rest of the world, young and old. Certainly no one need be ashamed to be seen with the Pictorial Annual, even though his only object be childish, unalloyed pleasure in the beautiful reproductions it places before his eyes. But the work has a further purpose than merely to give pleasure and excite admiration. It represents the year's progress in process work. Its splendid illustrations are given as examples of the perfection to which the art has been brought. These examples comprise, besides hundreds of smaller engravings, more than one hundred and seventy full page plates in from one to ten colors. Such reproductions as that of Constable's "The Valley Farm" are strikingly beautiful and effective. The text is a worthy accompaniment to the gallery of art, and deals with the difficulties and achievements of a fascinating craft in a thoroughly practical manner. "The Dec dence of Aquatint and Etching in England", is the subject of an article by Charles Harrup. Edmund G. Gress gives us "An American View of Typography." And there are articles on two-tone processes, filterless three-color reproductions, photographically-designed advertisements and illustrations, and on other subjects embracing a great variety of means and methods.

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Inquiry No. 9237.—Wanted, information relative to the Parmelee Automatic Aerated Water Still and Sterilizer.

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Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

George Ellery Hale

(Continued from page 23.)

displacements of the lines of various elements; discovery of magnetism in the sun by the photography of vortices and the detection of the Zeeman effect in the spectrum of regions around sun spots; investigation of the flash spectrum of the chromosphere, hitherto observed only for a second or two during a total eclipse of the sun; study of the general circulation of the solar calcium vapor and the local movements near sun spots; and a general investigation of sun-spot spectra, including wave lengths and origin of sun-spot lines, cause of weakened and strengthened lines, etc. These items will be sufficient to indicate the general nature of the work that is being done under Prof. Hale's direction at the present time.

In addition to his observatory achievements, Prof. Hale has rendered valuable service to science in two other ways; first, by the founding of the *Astrophysical Journal*, the leading publication in its field; secondly, by organizing the International Union for Co-operation in Solar Research. This union held its first meeting in St. Louis at the time of the World's Fair in 1904. Subsequent meetings have been held in Oxford, England, in 1905, Meudon, France, in 1907, and on Mount Wilson, California, in 1910. At the last meeting there were 84 delegates representing 12 different countries—a splendid tribute to Prof. Hale, the founder and always the prime mover in the union.

The value of Prof. Hale's work reckoned in dollars and cents would not be rated very high in Wall Street. But considered from a higher standpoint, as a contribution to human knowledge it must be accorded a most prominent place in the science of the day. The sun is a star. It is by far the nearest star to the earth, and can be most easily studied. Any addition to human knowledge in regard to the sun is a contribution toward the interpretation of the stars in general and of the universe as a whole.

This point of view has been brought out in Prof. Hale's book, "The Study of Stellar Evolution." Prof. Hale has been a very prolific writer, but this is the only popular work that he has published in book form. For over twenty years he has been a contributor to the leading technical journals of astro-physics and astronomy.

Sailing the Seas in a "Cockleshell"

(Continued from page 23.)

was for a run of 2,200 miles to the Azores, 900 miles from the Azores to Gibraltar, and another 900 miles to Rome *via* the Straits of Bonafacio.

Not many days after the "Seabird" had set sail to the eastward, there came into New York Harbor another little yawl, the "Pandora," which has just accomplished, on a much larger scale, the ocean-sailing feat now being attempted by the "Seabird." The "Pandora" is much bigger than the "Seabird," having, indeed, a length on deck of thirty-seven feet, nine inches, and measuring some nine tons.

The "Pandora" was built in Australia for two experienced navigators, Captain George Blythe, of Coventry, England, and Captain Peter Arakakis, a Greek. She was constructed for the express purpose of making a voyage entirely around the world, sailing to the eastward. The trip was made partly for experiment, but more in search of adventure. On May 3rd of last year, she set sail from the port of Bunbury, West Australia, and she has just completed her trip across the South Pacific and around Cape Horn to this port. She is not unlike the North Sea fishing boats; and her beam of fourteen feet gives her at once good stability and abundance of accommodations for her owner and skipper.

The craft set sail from Bunbury on May 3rd of last year and coasted to Melbourne, which was reached on May 29th. On July 10th, following, the coasting trip was continued, the next port of call being Sydney, which was reached August 16th; and the following day the little craft was headed eastward for New Zealand this being, of course, the real start of the deep-sea voyage. The run to Auckland is described by the Captain

as being the worst of the entire voyage. On August 28th the wind rose to the strength of a gale and then to a hurricane. The boat was stripped to bare poles, and even at that, shipped a heavy green sea, which swept her full length, and flooded her cabin. Part of the bulwarks was carried away. Finding that the craft could not run safely before a big following sea, she was hove to with a sea anchor. The sea anchor parted and a further section of the bulwarks was torn away; but with the aid of a trysail on the main mast the "Pandora" rode out the gale and reached Auckland, New Zealand, September 4th. There she remained for repairs until October 2nd, when she left for the Pitcairn Islands, which lie 2,750 miles east of New Zealand. On November 21st she passed the Pitcairn Islands and reached Easter Island on December 12th. After a brief stay the "Pandora" started for the Falkland Islands and made her stormy run around Cape Horn, which she passed on January 16th.

On January 22nd, during a fierce hurricane, the vessel was driving under bare poles and lashed wheel, when a heavy sea fell upon the vessel, turned her bottom up and finally, as the masts went by the board, brought her around again to an even keel, the little craft having been turned through a complete circle from left to right. A Norwegian whaler opportunely hove in sight and towed the "Pandora" two miles to the New Islands, where she was laid up for repairs.

She left the Falkland Islands on March 4th, for St. Helena, and sailed thence on April 26th, reaching Ascension Island on May 3rd. On May 7th, she started for New York, which port she reached June 23rd.

After spending six weeks in New York the two captains start for London on their journey via the Mediterranean and the Suez Canal.

Psychological Apparatus for Testing Chauffeurs

(Continued from page 29.)

the smoked paper. The tuning fork vibrates one hundred times a second, so that each of these indentations marks one one-hundredth of a second on the smoked paper. The slightest movement of the wheel, clutch, throttle, or brake in response to the signal flashed by the electric bulb, completes an electric circuit and drops the corresponding pointer on the revolving drum where it begins tracing a line on the smoked paper. And the number of vibrations of the tuning fork before wheel, clutch, throttle, or brake is in operation shows the hundredths of a second that have elapsed between the sight of the signal and the response of the mechanism—in other words the reaction of that particular chauffeur under that particular emergency.

With the three colors and the three apertures in the screen in front of the motorist, candidates for the privilege of driving motor cars in public places could be tested for the promptness and efficiency with which they would do the right thing under practically every possible emergency. Mr. Ricker has suggested the following table of signals:

White light in left opening—turn to right.

White light in right opening—turn to left.

White light in centre opening—slow down.

Three white lights—turn or slow down quickly according to position.

The white lights, it will be seen, represent conditions of ordinary travel. The green lights—which bring into play both foot clutch and steering wheel—are more serious, ranging from a released clutch and a turn to right or left according to the position of a single green light to a released clutch and a sudden swerve when three lights become visible. The red lights, finally, call for the emergency break as well as the released clutch and a quick manipulation of the steering apparatus—and three red lights at once might be fairly translated into "imminent death" and make a corresponding demand upon the reactions of the automobilist.

Suppose, for example, that the candidate has mounted into the dummy motor, has had the meaning of the various lights explained to him, and has been allowed to practice with them until the unfamiliarity of his position has worn off and his attitude is normal. Then the real test begins. A white light suddenly appears in the centre of the screen. It means "slow down" and the candidate reaches for the lever and makes the necessary movement, the time being caught and recorded on the smoked paper of the revolving cylinder. Then come three white lights in the centre, which again mean "slow down" but mean also, "be quick about it or somebody may get hurt!" The candidate again handles his lever, but this time the record on the smoked paper should show that he did it very much quicker than in the first instance. And so through various other combinations—with somewhere among them the sudden flashing of the three red signals and the record showing how many fractions of a second were needed for each saving movement at a moment when a difference of a few fractions of a second might in a real automobile be all the difference between a living motorist and a dead one.

Naturally the man whose nervous system is not actually up to the demands that may at any moment be made upon it in motoring would find it difficult to get permission to run a motor, but the average citizen would hardly feel that the weeding out of motorists fundamentally incapable of meeting the more serious emergencies would be a public misfortune.

[The reading of this article suggests the following comment: The chauffeurs reaction to a given signal comprises two separate and distinct steps, namely, first, interpreting the signal, and, secondly, responding to the particular emergency which such interpretation implies. What is measured is the sum of these two steps. This sum does not necessarily stand in any simple relation to the time required for the second step alone, and it is this and this only which is of interest in actual practise, where the danger signal is not some peculiar combination of lights, but a perfectly plain and unmistakable situation of real life. Probably the reading of a complicated set of signals would take longer than the response to it, even if the person under examination had been allowed previous practise. These considerations raise some doubt as to the value of the test proposed.—ED.]

Railway Building in Asiatic Russia: Paris-Peking in Nine and a Half Days.

AT the present time Russia has railway communication with her Pacific seaboard only through Manchuria. If you consult maps of Asiatic Russia published during the past eight or nine years you will find the route of a proposed railway indicated along the Amur River from Khabarovsk to Stryetensk on the Shilka (an upper tributary of the Amur); i. e. entirely within Russian territory. According to the *Revue Générale des Sciences* a credit has been voted for the completion of this railway. Another great project about to be undertaken will give St. Petersburg direct railway communication with the Trans-Siberian *via* Viatka, Perm, and Ekaterinburg, to Kurgan, in place of the present route *via* Moscow. Most important of all, it is proposed to build a railway from the termination of the present Chinese line, which extends from Peking to Kalgan, across the Gobi Desert, along the route of the old Chinese post road, *via* Sair-usu and Urga, to Kiakta, south of Lake Baikal. This would enable travelers to journey from Paris to Peking in nine and a half days!

Water Tunnel Beneath Manhattan Island.—The water supply tunnel which is to run at a depth of several hundred feet below Manhattan Island for distributing the water which will be brought down from the Catskills by the aqueduct, will be built for $19,084,637, which, in view of the fact that the estimated cost was $25,000,000, must be considered very satisfactory.

Aeronautics

Progress of the Paris-London-Paris Aeroplane Circuit Race.—After several days of bad weather, which delayed the start of the fourth stage of the race from Utrecht (Holland) to Brussels (Belgium), twelve of the fourteen aviators that arrived in Utrecht started for Brussels on June 26th. The distance of this stage was 93¾ miles, and the total distance to Brussels 455¾ miles. Even after waiting two days the aviators were obliged to fly in a violent wind and heavy rain showers. Lieut. Conneau was the first to reach Brussels. He alighted in his Blériot at 5:30 P. M., and was followed soon after by Vedrines on his Morane monoplane. The latter was presented with a laurel wreath with the inscription, "To the Victor of the Paris-Madrid Race." In all seven aviators arrived up to 9 P. M., Renaux, with his passenger, being the last, with a total time in flight for the 455¾ miles of 39 hours and 49 minutes. Lieut. Conneau's time was 37 hours, 27 minutes, and the times of the other aviators were as follows: Kimmerling, 37:34; Vedrines, 38:01; Garros, 38:33; Gibert, 38:56; Duval, 39:07; and Wynmalen and Vidart, who arrived the next morning, 52:46:32 and 60:52:52.

Delivering Mail by Aeroplane.—Upon the departure of the huge "Olympic" on her first eastern trip from New York on June 28th, Aviator Tom Sopwith attempted to drop a message on board the steamer when she was passing through the Narrows. Accompanied by Richard R. Sinclair, he left the aviation field at the Nassau Boulevard at 3:27 P. M. He flew over Brooklyn and circled above New York Bay. At length, when 1,000 feet in the air, he discovered the "Olympic" just as she reached the Narrows. He made for the liner post haste, and flew down to within 200 feet of her before dropping the package. This missed the deck by a few feet and was lost in the bay. Nevertheless, the possibilities of the aeroplane for delivering mail were demonstrated in a practical way. As the speed of an aeroplane can be regulated so that it is no faster than the speed of a giant liner, it is possible for the aeroplane to come up astern of the liner and hover above her while mail and packages are not only dropped aboard the steamer, but while they are also hoisted up to the aeroplane to be brought ashore.

Accidents in the Fourth Stage and Results of the Fifth Stage of the European Circuit Race.—On account of the extremely bad weather conditions, several aviators came to grief in the fourth stage of the above-mentioned race. M. Tabuteau fell and wrecked his Bristol biplane at Gilze, a short distance from the Belgian frontier. Vidart (Deperdussin monoplanes) and Prevost and Train were also stalled at the same place. Train completed the race the next day, as did also Wynmalen, whose H. Farman biplane was stalled 35 miles from Brussels. Le Lasseur's Blériot fell near Breda, slightly injuring the aviator. Barra arrived at Brussels the evening of the 27th. His M. Farman biplane landed heavily, but he was not injured. Emile Train arrived the same evening. He was the last one to finish this stage. The winner of the race to this point received a cash prize of $8,000, and also $3,000 additional for winning the fourth stage. The fifth stage of the race, a distance of 56¼ miles from Brussels to Roubaix (France), was flown by ten of the competitors on Wednesday, the 28th ultimo. Vedrines was the first in this stage of the race. He arrived at 11:04 A. M., having covered the distance in 58 minutes 46 seconds (57.4 miles per hour). His fast flight won him the biggest part of the $3,000 prize given by the Roubaix Exposition for the fastest time. Garros arrived second at 11:17 A. M., his time for the 56¼ miles being 1¼ hours. He was followed by the remaining aviators in the order named. Kimmerling (time, 1:11), Conneau (1:24), Vidart (1:58), Renaux (1:54), Gibert (2:06), Valentine (1:37), Train (4:09), Prevost (4:43). Wynmalen and Barra postponed their flight until the next day on account of the heavy winds. Duval fell before he reached the frontier. His Caudron biplane was wrecked, but he was not seriously injured.

Electricity

Explosion in a Nitrogen Plant.—According to a press report the nitrogen works at Trostberg, Bavaria, were recently destroyed by an explosion. At this plant, in which American capital was invested, nitrogen was recovered from the atmosphere by the electric arc.

Wireless Telegraph Station.—The German Postal and Telegraph Department is taking measures to erect wireless telegraph stations on the Baltic at Swinemund and Königsberg, and another will be installed on the North Sea on the Sylt Island. It will be remembered that wireless plants are already in operation at Heligoland, Cuxhaven and Norddeich. This latter station, which ranks among the principal wireless plants of the Continent, is soon to be enlarged.

Telephones in Fire Alarm Boxes.—Fire alarm boxes fitted with loud-speaking telephones are now installed in the suburban district of Kiel, Germany, and they are placed at various points along the streets. This appears to be the first time in which loud-speaking telephones have been applied to fire alarm use. The telephones are mounted in an iron box, and upon opening the cover an electric contact is made which rings up the nearest Fire Department station. Owing to the use of such telephones the voice is always heard clearly, in spite of the street noises.

Lighting the Turin Exposition.—For lighting the grounds at the Turin Exposition, there is to be used a very neat method. As the grounds extend along the sides of the river for some distance, it was decided to use 130 arc lamps, which will all be connected in series, so that the current coming from the city mains at 6,300 volts can be used directly for the whole system. For a given number of lamps it is a well-known fact that the size of the wiring is cut down as we raise the voltage. For instance, if all the present arc lamps had been connected in series of four upon a low voltage of 220 volts, 29 tons of copper would be needed for the wire. By using 130 lamps in series, only two tons of copper are required. The new German Conta lamp is used.

New Lamp Filament.—A new metallic filament for incandescent lamps is made by the Regina firm, and it is having some success in Germany. Tungsten is combined with carbon by a process invented by Hopfelt. First a tungsten filament is made, and this is covered with a layer of carbon by suitable means. This is said to give a very hard and elastic filament for lamps, and it runs on a small current. Some 32 candle-power lamps of this kind were put through a test at the Cologne municipal electric plant, and were found to burn for 2,000 hours and over in some cases. They take 1.04 watts per candle-power when new, and 1.13 after 2,000 hours' run. When the lamps are placed horizontally the life is less, or 1,500 hours. The new lamps are made in sizes up to 600 candle-power. Some of them have the new Euphos glass bulb, which is of a slight yellowish-green hue, and absorbs the ultra-violet rays, so that the light is safer for the eyes. The present lamps are made to run on 100 volts.

Re-chargeable Dry Batteries.—A new electric dry battery is now being introduced in London, according to the *Electrical Review and Western Electrician*, which is claimed to have a useful life up to three and one-half years, and as the deterioration when it is not in use is negligible it will retain its charge for several years. It may be re-charged several times in the same way as a storage battery. For the negative element a number of zinc plates are employed and for the positive element a carbon rod is imbedded in a composition formed of charcoal and manganese oxide, surrounded by a mixture of ammonium chloride, chloride of lime, and zinc chloride. These elements are placed in an electrolyte consisting of amylon, obtained from the sago palm, with exciting salts composed of platinum-ammonium chloride and zinc-ammonium chloride. This electrolyte, which is in the form of a jelly, is claimed to retain its moisture for long periods and to be but little affected by variations of temperature.

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Nos. 1816, 1817, 1818, 1819, 1820, 1821 and 1822. **The Practice and Theory of Aviation.** By Grover Cleveland Loening, A. M. This is the most compact paper on aeroplanes that has probably ever been published. Fourteen biplanes and monoplanes are described in detail, and illustrated with scale drawings, namely, the Farman, Cody, Curtiss, Wright, Voisin (old model), Voisin (new model), and Sommer biplanes, and the Antoinette, Santos-Dumont, Bleriot XI, Bleriot XII, Grade, Pelterie and Pfitzner monoplanes. The proper dimensioning of aeroplane surfaces, as deduced by famous experimenters from their tests, is also considered. Taken as a whole this series of seven papers constitutes an admirable text book.

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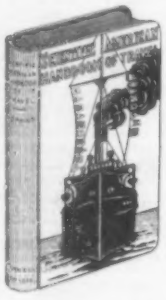

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